FLIGHT and The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

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Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

COVENTRY:	BIRMINGHAM, 2:	MANCHESTER, 3:	GLASGOW, C.2:
8-10, CORPORATION ST.,	GUILDHALL BUILDINGS, NAVIGATION ST.	260, DEANSGATE,	26B, RENFIELD ST.,
Telegrams: Autocar, Coventry.	*Telegrams:* Autopress, Birmingham.	*Telegrams:* Iliffe, Manchester.	*Telegrams:* Iliffe, Glasgow.
Telephone: Coventry 5210.	*Telephone:* Midland 2971 (5 lines).	*Telephone:* Blackfriars 4412.	*Telephone:* Central 4857.

SUBSCRIPTION RATES: Home and Abroad: Year, £3 1 0. 6 months, £1 10 6. 3 months, 15s. 3d.
Registered at the G.P.O. as a Newspaper.

No. 1741. Vol. XLI. MAY 7th, 1942. Thursdays, One Shilling.

The Outlook

"Tails Well Up!"

THERE is definitely something in the air, literally and figuratively, this spring. Although we have not really got into our stride so far as available aircraft are concerned, we have already got together, thanks to the unstinting efforts of British and American firms, enough to give the Hun a taste of his own medicine in doses which are proving highly effective. And, as was to be expected, he does not like it. Gone are the days when the British Isles had perforce to owe so much to so few. We now owe much more to many more, and we are only at the beginning of our real power in the air. The Royal Air Force would be the first to give credit to our factories. Management and workers alike have put their backs into the task, and although there is still room for improvement (there always is), we are entitled to a justifiable pride in what has already been achieved. The R.A.F. is being given the tools, and it has started in real earnest to finish the job.

Listeners who understand German must have smiled to themselves if they happened to tune-in to Luxembourg on April 24th. This was the day after the first raid on Rostock. Some unwise remarks were made that day by Maj. Wulf Bley. After referring to the air attacks made in the war 1914-18 on the German hinterland with the aim of destroying armament production and supply routes, the gallant major continued:

> "To-day German air supremacy has made it impossible for the enemy to endanger German production and supply lines, and has established the basis for successful German attack on enemy production and supply lines. That means that Germany, owing to her superior strategy and the greater striking power of her air force, is able to paralyse the enemy to an extent which he cannot approach, even in a slight degree. German air defences have effectively guarded German industry and food production. At no time has the enemy been able to paralyse the production of vital goods or to hamper their transport. The Soviets did not get as far as operations over Germany at all. The British have tried it but failed, suffering such heavy losses that they could no longer be borne."

That broadcast was sent out, as we have said, the day after the first raid on Rostock. Goebbels was evidently caught napping; the talk was scheduled and duly given. Both the Herr Doktor and the Herr Major must have felt somewhat silly a day or two later, and workers at the Heinkel factory, not to mention the other inhabitants of Rostock, can hardly have been enthusiastic about the cocksure major's effusion.

Bombing for the Navy

LÜBECK and Rostock are Baltic ports, and the damage done to them by Bomber Command has been a help to the general war effort of the United Nations. It would be over-straining the process of analysis to classify these raids as help for either of the other Services. In previous wars it was generally considered that it was part of the duty of the Royal Navy to interrupt the sea-borne traffic of the enemy and to protect our own. From that point of view, the R.A.F. was helping the Navy by these particular raids. But at the same time these ports were bases for intercepting the supply of material to Allied armies (in this case the Russian armies, but in this war all the United Nations are as one), and, therefore, these raids were certainly a help to the Allied land forces.

The next step taken by Bomber Command, doubtless

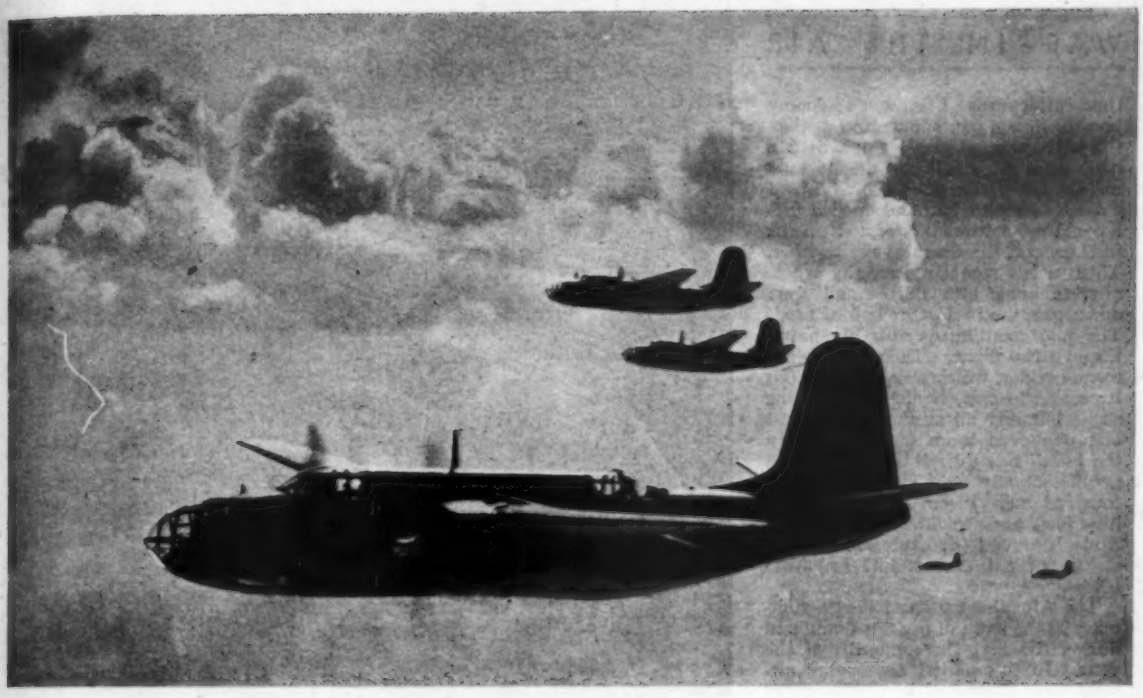
at the request of higher authority, was to raid Trondhjem and Kiel, in both of which German warships are certainly lying. The damaged *Scharnhorst* is known to be in dock at Kiel, undergoing repairs, while at Trondhjem there still may be the battleship *Tirpitz*, which was probably hit by a British torpedo not long ago, the *Admiral Scheer*, the *Prinz Eugen*, and perhaps another cruiser of the *Hipper* class. If these ships had all been repaired and made ready for sea, they would be a formidable fleet—not one capable of wresting from the Royal Navy the command of the seas, but certainly of doing great damage as commerce raiders. They might get loose in the Atlantic and hit our convoys hard, or they might work on the route which leads to Northern Russia. Aerial photographs taken by the R.A.F. have shown that the three warships which escaped from Brest are all undergoing repairs, though it is not certain whether most of the damage was done during their passage up Channel or subsequently. These latest raids on Trondhjem and Kiel may have given the repairers still more work to do. If so, Bomber Command has performed a notable service to the Allied cause.

German Reprisals

THE German so-called reprisals for the activities of Bomber Command have been, apart from the tragedies which they have caused, of a pitiable nature. The lords of the *Luftwaffe* have selected a number of cathedral cities in England and bombed them. Exeter, Bath, Norwich, York, all have suffered. The German papers say that they are selecting places marked with three stars in Baedeker. The German mind is incapable of grasping the idea that great works of art belong, not merely to the country in which they happen to be situated, but to the common culture of the whole world. The modern Huns do not even consider the feelings of their subordinate allies, for educated Italians would lament, as heartily as we British should do, the destruction of the Roman baths in *Aquæ Sulis* (fortunately they escaped) in which so many famous Romans of old must have enjoyed a swim. Cultured Italians, by the same token, must regret the devastation of the historic buildings of Malta, for the island is closely connected with the history of Italy.

While selecting places precious to world culture, it seems likely that the Germans also reckoned that such places would be less heavily defended than the great centres of British war industry. Consequently they could do much damage with a small number of bombers. They worked with forces of about twenty aircraft, which is a big contrast to the heavy raids they were sending over eighteen months ago. It is obvious that the Germans do not want to risk heavy losses in the air just as the fierce summer campaigning season is about to start. But they forgot the efficiency of British fighters, especially on moonlight nights. The percentage of losses which they have suffered has been high, sometimes 25 per cent. of the raiding force, while the damage to Britain's war effort has been nil. Even Prussians can hardly think that a satisfactory balance-sheet.

AFTER THE BLITZ WAS OVER: A remarkable daylight photograph of the damage done to the Heinkel works at Rostock. (1) The main assembly shop showing the damage done by direct hits of heavy bombs. (2) Fuselages and aircraft salvaged from the main assembly shop. (3) Another assembly shop damaged by blast. (4) A considerable portion of the machine shop burnt out and roofless. (5) Damage to workshops by blast. (6) Paint shop roof and camouflage wrecked. (7) Other buildings completely burnt out. A night photograph taken while one of the four raids was in progress appears on page 444.



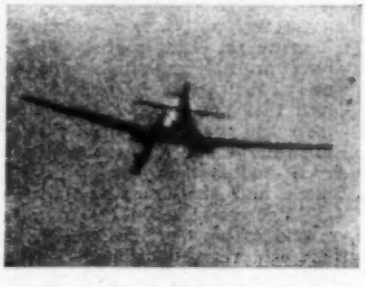
An exclusive *Flight* photograph of a squadron of Douglas Boston IIIs which have been daylight-bombing the enemy so effectively.

War in the Air

The King with his Fighter Pilots : Fierce R.A.F. Bombing : The Germans Raid Cathedral Cities : The Japanese Take Lashio

SWEDES living near the Norwegian frontier said that they heard the reverberations of the bombs dropped by the R.A.F. in one of their raids on Trondhjem last week, even though they were nearly 150 miles away from that port. The inference is that on that night some of the British bombers did not concentrate their attention on the harbour, where German warships may be lying, but went for targets further inland, and probably hit a munitions dump. We hope, none the less, that one of the raids did hit the *Tirpitz* and her consorts in the harbour, as they might do a great deal of damage if they all got loose either into the Atlantic or on the route to Russia. Kiel, where the *Scharnhorst* is still probably undergoing repairs, has also had to suffer another visitation from Bomber Command.

Fighter Command has also been energetically keeping up its offensive sweeps, often escorting Boston bombers. One afternoon it was reckoned that there were no less than 100 German fighters in the air, but they did not all show any great desire to come to grips, and some of our pilots returned to their base without having fired their guns or cannon. On that same afternoon, as the Spitfires landed, the pilots found the King waiting to welcome them and to talk to them about their experiences. Among these pilots was a Flight Lieutenant, with D.F.C. and bar, who, when a sergeant, had shot down the German machine which bombed Buckingham Palace. While the raid was on, the King went into the operations room of the station which he was visiting, watched the plotting being done, and listened to the voices of the pilots as they talked to each other and to the base.



SHOWING A LEG: The undercarriage of an Me 109 drops as Fighter Command bullets find their way into the "plumbing."

To the fierceness of the R.A.F. offensive the German reply has been a series of raids on cathedral cities in England, in which they have used small numbers of bombers and have lost a high percentage of them to the R.A.F. fighters. So far as the respective war efforts of the two countries are concerned, Britain has actually gained more than she has lost by these German efforts; but the damage to ancient buildings is a loss to all civilised humanity, and the casualties to civilians make a tragedy which helps nobody.

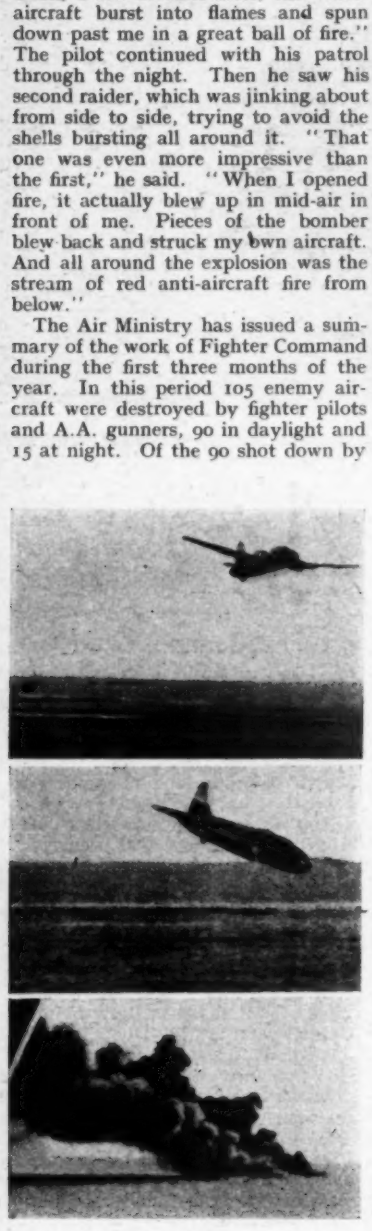
Alexandria is another city which has also been bombed by the enemy again, and on April 28th over 100 people were killed and many more were wounded.

Alexandria also has night fighters who can hit back. A South African Squadron Leader shot down two raiders that night. "When the alarm was sounded," he said, "I hurried out to my aircraft and took off. Some

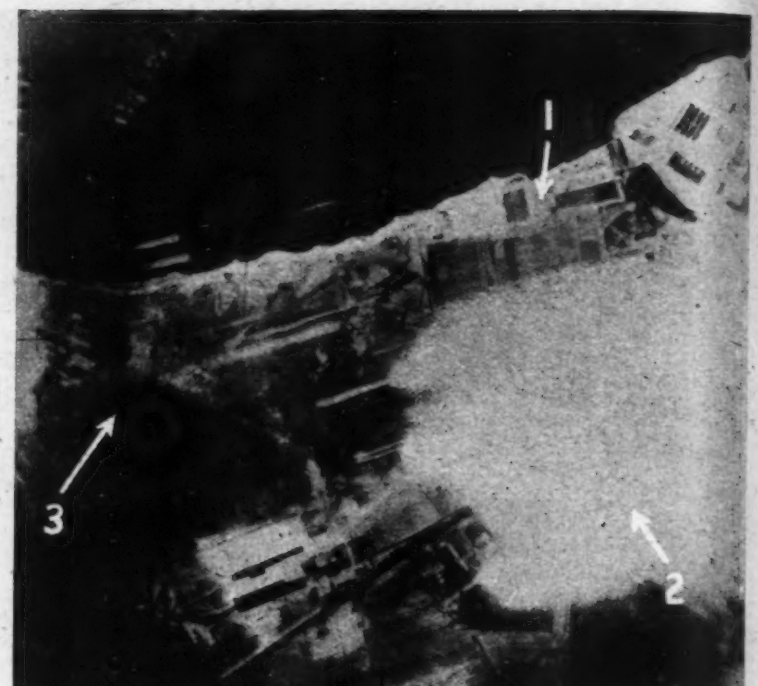
WAR IN THE AIR

time afterwards I saw an enemy bomber above me, silhouetted against the night sky. I don't think he can have seen me at all because he took no evasive action as I closed in. I got very near to him and opened fire. I could see several hits scored on the fuselage and the wings of the bomber. Then, a few seconds later, the whole aircraft burst into flames and spun down past me in a great ball of fire." The pilot continued with his patrol through the night. Then he saw his second raider, which was jinking about from side to side, trying to avoid the shells bursting all around it. "That one was even more impressive than the first," he said. "When I opened fire, it actually blew up in mid-air in front of me. Pieces of the bomber blew back and struck my own aircraft. And all around the explosion was the stream of red anti-aircraft fire from below."

The Air Ministry has issued a summary of the work of Fighter Command during the first three months of the year. In this period 105 enemy aircraft were destroyed by fighter pilots and A.A. gunners, 90 in daylight and 15 at night. Of the 90 shot down by day, 79 were accounted for in offensive operations over enemy territory. During the same period Fighter Command lost 61 aircraft. Two of the pilots are safe, and others are known to be prisoners of war.



THE RISING SUN SINKS: Three stages in the destruction of a twin-engined bomber. (Top) It is hit, the port engine has gone and the wing is damaged. Note the starboard aileron hard up to keep the machine level.



NICE WORK: The fires blazing during the R.A.F. attack on the Heinkel aircraft factory at Marienehe, near Rostock. It is here that the new four-engined He 177 is being produced. 1—Part of the Heinkel aircraft factory outside Rostock. 2—Considerable fire in southern part of factory. 3—Runways on Marienehe airfield. Note the aircraft seen in the light of the fire. A picture of the factory, taken after the fires had subsided, is on page 442.

Middle and Far East

THE news from Burma is bad. The Japanese have captured Lashio, the town at the end of the Burma road, which must have been one of the main objects of their invasion of the country. The probability of this loss has been foreseen for some time past, and there have been announcements in both India and the United States that other means would be found for getting supplies through to China. What the plans are has necessarily been kept secret, but geography imposes limiting factors, and there are obviously not many promising routes. Fighter aircraft probably rank high among the needs of the Chinese forces. It is believed that the American Volunteer Group has withdrawn bodily from Burma into China. Quite recently the A.V.G. had another very good day in Burma, and shot down 22 Japanese "O" fighters. These "O" machines are said to be very nice to fly, but they are very light and without armour to protect the pilot. They would stand a very poor chance against Hurricanes or modern American fighters. But when they meet with little opposition, as has happened on many occasions in the Pacific war, they have given our forces a lot of trouble.

Mr. Curtin, Premier of Australia, and Mr. Drakeford, the Air Minister, have both spoken frankly about the danger to the Commonwealth. Despite the grand efforts of the R.A.A.F. and its American partners, Australia is still in danger of invasion. In recent weeks the Japanese have lost 130 aircraft in the New Guinea area, and over 100 more have been damaged, but the Australian Ministers said that they could afford that loss. Still, for the time being the air attacks from Australia have prevented the enemy from establishing a base in New Guinea from which he could work with ease in any attempt to invade the Dominion. American help has been pouring in to Australia, and the defences grow stronger every day.

It is sad, however, to learn that the American Brig. Gen. H. H. George, of the Army Air Corps, who came from the Philippines to Australia with Gen. MacArthur, has been killed in a flying accident there. He had gained a Distinguished Service Cross as a pilot in the last war.

The strange lull in land operations in Libya continued up to the end of April. Sand storms kept the troops quiet on some days, but weather hardly accounts for the stalemate position which has lasted so long. There has been patrol activity, with general

WAR IN THE AIR

ENEMY AIR LOSSES TO MAY 2nd.

	Over G.B.	Over Continent	Middle East
April 26	2	6	3
" 27	1	11	5
" 28	6	4	5
" 29	0	2	4
" 30	8	9	4
May 1	0	1	0
" 2	0	0	0
	17	33	21

Totals: North 5,836; Middle East, over 3,738; Far East figures not reliable.

success on the British side, and the R.A.F. has continued to fly and to harry the enemy as much as possible.

In the Mediterranean the Middle East Command has been using both bomb and torpedo with effect against the enemy's shipping on the way to Africa. The enemy has been sending escorts of aircraft as well as destroyers with his convoys, but on one occasion of the sort our machines shot down two Dornier 18s, while two Italian fighters, which were also with the convoy, failed to hit our machines. The tanker which was being escorted was hit by cannon fire, and clouds of smoke and steam were pouring from her as our aircraft left. Both the Dorniers were shot down by Belgian pilots who were members of the British squadron.

H.M.S. *Illustrious* has been visited at a northern port in Great Britain by Rear Admiral A. L. St. G. Lyster, Fifth Sea Lord, who flew his flag in her when her T.S.R. aircraft wrought such havoc to the Italian Fleet at Taranto. After the battle of the Sicilian Straits the carrier was repaired at Norfolk, Virginia, and the Navy yard there presented the ship with a bell to replace the one which was damaged by bomb splinters in the battle.

WINGS OF THE ARMY: A photograph of the badge which will be worn by army pilots of gliders and observation aircraft. The latter will be known as air observation post pilots. It is worked in pale blue on a black background.

The naval Distinguished Service Medal has been awarded to Gunlayer H. H. G. Farley, who is the first gunner in a merchant ship to receive such a decoration. He has shot down three enemy aircraft which tried to bomb the ships in which he was serving. His latest victim was a Heinkel lll shot down on December 18th, 1941.

Widespread Activities

THE evacuation of Mandalay, coming so soon after the loss of Lashio, is deplorable, but hardly unexpected. If it is the case, as has been stated, that it was Burmese jealousy of India and a desire to check the movement of Indians into Burma, which prevented the making of good land communications between the two countries, Burma is paying a heavy price for her isolationism. It is more probable that no one expected that Britain would lose command of the Bay of Bengal; and sea transport was so easy compared with the engineering difficulties of connecting the two countries by rail and road, that things were just left as they were. But Chinese bombers and A.V.G. fighters can still swoop down from China on to the Japanese, and they have made a successful raid on the Lashio airfield and barracks.

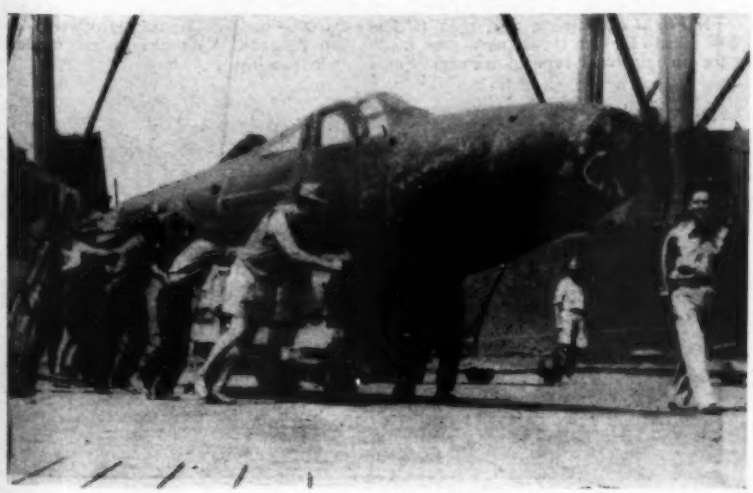
It appears that a new chapter in the Middle East offensive was opened by the attack by Wellingtons on the Axis submarine base in the island of Leros in the Dodecanese. It is notable that Reuter's correspondent now describes Wellingtons as "medium-heavy" bombers. Perhaps the Middle East is to get the real "heavy" bombers. The Wellingtons dropped special anti-submarine bombs which are calculated to damage the plates of a U-boat even if they only fall near it. The Wellingtons came from six squadrons based in the Western Desert, and they had a most successful moonlight raid, meeting with little opposition. Each machine carried a ton and a half of bombs.

The regular bombing of Benghazi goes on well nigh every night, with little intermission.

While everyone is surprised at Hitler's delay in launching his spring offensive, some initial activity has taken place in the form of German bombing raids on the Russians in the Kerch peninsula. The Germans have not mentioned the use of dive-bombers there, from which it may be concluded that their mastery of the air is far from complete.

In the northern area, aerial reconnaissance and photography have shown that for some time to come there is no danger of a strong German fleet steaming out to dispute the mastery of the Atlantic. The *Gneisenau* is at Gdynia in Poland, and is severely damaged along the whole length of her forecastle. The *Scharnhorst* is still in the hands of dockyard workers at Kiel, while the *Prinz Eugen*, which was torpedoed by H.M.S. *Trident*, is at Trondhjem, and her after-part needs very considerable repair. Some of the damage to the first two may have been done during their passage up the Channel, and later they may have struck British mines.

During April, Bomber Command sent raiders over German territory on nineteen nights, and in six of those nights 1,300 tons of bombs were dropped. The Command lost 144 aircraft. Fighter Command attacked on twenty days, losing 99 machines and destroying 77.



FOR FAR EAST ATTACK: Bell Airacobra fighters being landed at an Australian port.

BRITISH AIR LOSSES TO MAY 2nd.

	Over G.B. A'crft.	Over Continent B'brs	Over Continent Ftrs.	Middle East A'crft.
April 26	0	2	4	3
" 27	0	17	20	2
" 28	0	9	6	2
" 29	0	6	2	2
" 30	0	0	4	0
May 1	0	1	8	0
" 2	0	2	0	0
	0	37	44	9

Totals: North, 3,645; Middle East, about 1,101; Far East figures not reliable.

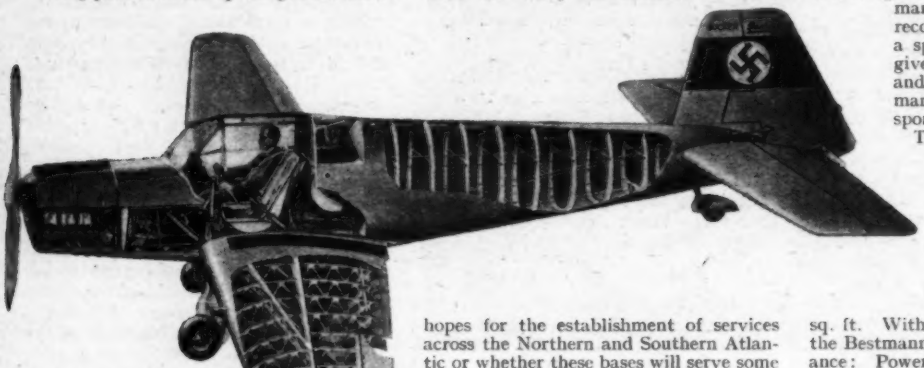
BEHIND THE LINES

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Catch Them Young

UNDER a new system established by the *Luftwaffe* the training of N.C.O.s begins at the age of 17. Selected volunteers who wish to become regular N.C.O.s are admitted to these schools and trained for one year. During this period the training is on general military lines but special attention is being paid to brush up the general knowledge of pupils and to prepare them for their future branch of service.

Trainees pass out with a rank of L.A.C. and are posted to a unit. After attending further courses for a period of two years they are promoted to the rank of Corporal. Training is reported to be more thorough than for other recruits, and the period of service for which the volunteers sign on is 12 years.



THE BEST MAN: Bücker Bü 181 trainer. Powered with a four-cylinder air-cooled Hirth HM500 engine of 105 h.p., this aircraft is now widely used in Germany.

Luftwaffe Generals

TOGETHER with a number of promotions in the German Army and Navy, the *Luftwaffe* staff of Generals has also been expanded. Lt.-Generals Waber, Coller, Dessloch, Speidel and von Seidel have been promoted to the rank of General der Flieger (full General).

Vichy Air Force

IN an interview granted by General Bergeret to the Correspondent of the *Journal de Geneve*, the chief of the Vichy aviation gives the following interesting details:—The strength of the personnel of the Air Force is 55,000, of which 15,000 are N.C.O.s. They are mainly recruited from volunteers. The pay for privates is 10 francs per day, while the N.C.O.s receive 1,200 francs a month with free accommodation, and a small deduction for messing. In Grenoble a school has been established for the benefit of the children and orphans of the Air Force personnel.

Single-seaters Dewoitine, Bloch 175 and Leo 45 have been ordered for the Air Force, while the Naval Air Arm is being equipped with Loire aircraft and reconnaissance seaplanes, Laté 298.

As far as civil aviation is concerned, General Bergeret stated that the Marignane, Maison-Blanche (Algeria), and Dakar airdromes are being re-equipped and the seaplane bases at Marignane and Dakar expanded. Whether this indicates that the Vichy Government entertain hopes for the establishment of services across the Northern and Southern Atlantic or whether these bases will serve some other purpose remains to be seen.

In the sphere of civil aviation greatest attention is being paid to transatlantic types of aircraft, such as the SE200 of 70 tons, the Laté "Marshal Pétain," the Cams 161, and another 70 tons aircraft constructed at Marignane by the Société National du Sud-Est, the SE 200 No. 2. Other commercial aircraft, Breguet, Cams and Bloch, capable of carrying 24 passengers, are in construction.

In conclusion the General stated that the Hispano Company are active at Tarbes while the Gnome-Rhone are engaged at Limoges on the manufacture of their range of engines from the 14N to the 14R.

German Trainers

IN *Flight* of October 2nd, 1941 ("The Ideal Trainer"), a plea was made for an improved type of trainer. Some of the features then suggested can now be found in the two German trainers illustrated on this page. The Bücker-Bestmann (Bü 181) is a two-seater cabin low-wing monoplane for initial and advanced training. The cabin, which is 4ft. wide, has sufficient space to allow a side-by-side seating of instructor and pupil. Seats are adjustable, and an adjusting device for the pedal controls can be operated during flight. The Bestmann can be safely stalled, and recovers with free controls from a spin. Special attention was given to allow good visibility and to make the machine manœuvrable and quickly responsive to the controls.

The Bestmann has a cruising speed of 124 m.p.h., with a power output of 85 h.p. at 2,350 r.p.m. Throttled down to 112 m.p.h., it has a range of 520 miles. Span, 33ft. 9in. Length, 27ft. 9in. Height, 6ft. 6in. Wing area, 145 sq. ft. With a total weight of 1,333 lb., the Bestmann has the following performance: Power loading, 11.22 lb./h.p. Landing speed, 43.49 m.p.h. Climb up to 3,280ft. in 3.6 min., up to 6,561ft. in 8 min., and up to 9,842ft. in 13½ min. Ceiling, 19,685ft. The fuel consumption at 124 m.p.h. is 2.88 gall./h. Permissible diving speed is 267 m.p.h.

Low-wing Floatplane

The Arado—Ar-199—is a twin float low-wing all-metal monoplane. The cabin is suitably elevated, and gives the instructor and pilot good visibility. Side-by-side seating is arranged, with one seat in the rear for a wireless operator for longer flights. The aircraft can also be launched from catapults. Span, 41ft. Length, 34ft. 5in. Height, 14ft. 3in. Total area, 325 sq. ft. Climb, 9,840ft. in 11 min. Ceiling, 21,325ft. Speed, 161 m.p.h. at 9,000ft. Landing speed, 50 m.p.h. The aircraft is powered with an As-410-C V-shaped in-line engine of 380/540 h.p.

A NAVAL TRAINER: The Arado Ar-199, a twin-float all-metal aircraft used in the training of the *Luftwaffe's* naval pilots.

POWER UNITS of the FUTURE

A Summary of the Aircraft Engine Position Throughout the World

By JOHN W. MORRISON

THE high specific power output of modern aircraft engines has been made possible by the development of high-octane fuels. Without 100-octane petrol we might well have lost the Battle of Britain. Recently, fuel technologists have produced "110-octane" fuel, which is 50 per cent. more powerful than 100-octane, and 66⅔ per cent. more expensive. Naturally, existing engine designs cannot take full advantage of 110-octane fuel, because it is too powerful. However, with strengthened redesigned engines sufficient quantities of the new fuel could quickly be made available for our offensive sweeps over France and occupied territories within the range of our fighters. For the present Britain and the United States have apparently decided not to change over to 110-octane for two important reasons:—

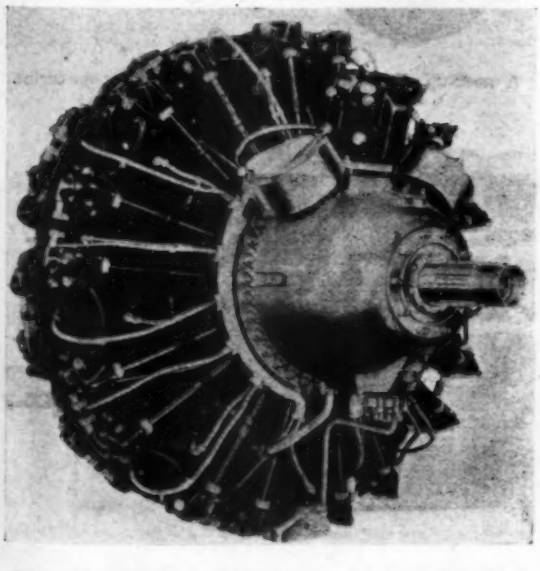
(1) The dislocation of production that would result if all our engines had to be modified and strengthened.

(2) A gallon of 110-octane petrol costing about 2s. contains the vital ingredients of 1½ gallons of 100-octane.

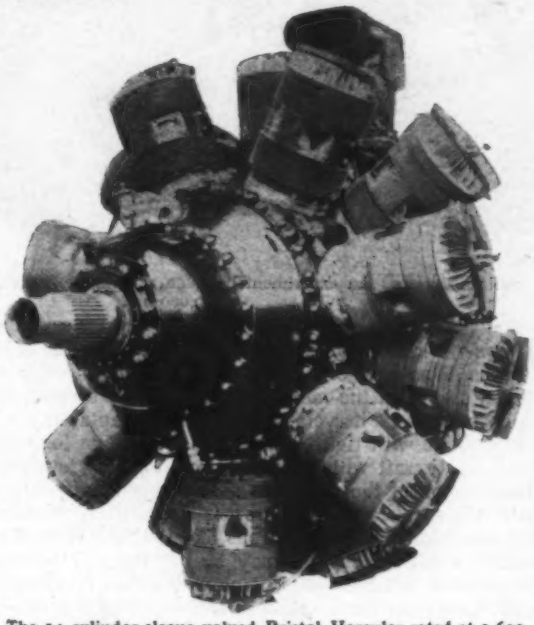
Summarising the advantages of 110-octane petrol, *Time* has recently stated that some day a machine will be able to fly either from New York to London on the same amount of fuel it now takes to fly from Newfoundland to London, or to carry about 30 per cent. less fuel and, therefore, a very much larger payload.

Titanic Power

Engines of titanic power, power that would not shame a steam turbine of substantial proportions, are under development in America. As most of us know, it is not often that Americans fail to "tell the world" when they have something big on the way, Hitler or no Hitler.



Pratt and Whitney Double Wasp. An 18-cylinder radial engine with a take-off power of 1,850 h.p. at 2,600 r.p.m.



The 14-cylinder sleeve-valved Bristol Hercules rated at 1,600 h.p. at 2,900 r.p.m. for a weight of 1,850 lb.

Personally, I applaud this attitude; it is like a breath of fresh air in a world of suppression. In a widely quoted article in *The Atlantic*, October, 1941, the well-known aircraft designer, Major Alexander P. de Seversky, wrote: "I am disclosing no secret in asserting that research is proceeding successfully on airplane engines that develop as much as 8,000 h.p.! Imagine a plane like the B-19 equipped with four such engines, plus other vital improvements already available, and you will grasp the emerging revolutionary possibility of *ranges circling the entire globe** (25,000 miles) with ample margins for tactical operations."

After that utterance I don't think anybody will accuse de Seversky of being unduly pessimistic.

American Engines

America has been described as the home of the radial engine. All American bombers are powered by Wright or Pratt and Whitney air-cooled radial engines, and all have a maximum speed in excess of 300 m.p.h. At the moment the Double Wasp appears to be the most sought-after unit for medium bombers, troop-carriers and large fighters. I understand that the 2,500 h.p. Wright Tornado engine has been selected to power the newest Lockheed, Boeing and Consolidated heavy bombers that were announced last year. These bombers will be similar in size to the original Douglas DC4, and will fly at great altitudes at a speed that would do justice to a Spitfire.

Although the vast American motor car industry is now turning out air-cooled engines, a good number have been developing their own aircraft motors, which may be very briefly referred to:—

* Writer's italics

Allison V.3420. An experimental double vee engine. The reported power is about 2,000 h.p.

General Motors Corp.: The 1,325 h.p. liquid-cooled Allison V-12 engine is now in full production. In the writer's opinion the most remarkable feature about the Allison engine is its very wide range of adaptability. It is available with right- and left-hand rotation for twin-engined aircraft with oppositely rotating airscrews; the rear section of the reduction gear casing is not integral with the crankcase, and thus it is immediately available for extension-shaft installations like the Bell Airacobra, and two Allison engines may be put together to form the Allison Double V-24 engine with either one-way or contra-rotation for co-axial airscrews without reversing gear. Since the dry weight of the Allison is 1,320 lb. (F type), the specific weight is less than 1 lb./b.h.p. The very great importance of planning well ahead in order to embrace the greatest possible number of diverse installations is certain to be even more apparent in the future.

Development Work

Briggs: It has been reported that Briggs are working on a very powerful engine. I have already referred to the ultra-lightweight pressed-steel atomic hydrogen-welded engine that has been developed in America with the extraordinary specific weight of only 12.8 oz./b.h.p.; it is possible that Briggs are fabricating such an engine in the 3,000 h.p. class.

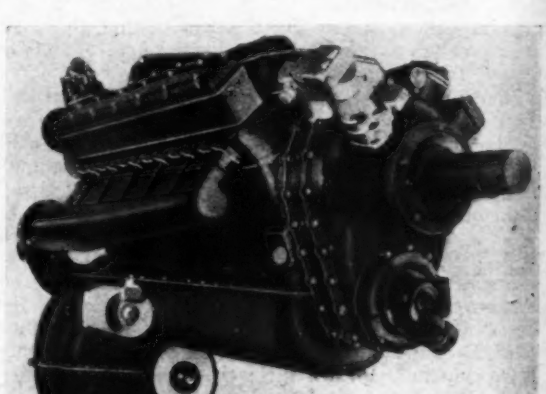
Chrysler: This company is known to be developing a liquid-cooled engine, reputedly a V-12 of about 2,000 h.p.

Continental: For some years this firm has been developing an opposed 12-cylinder engine of about 1,500 h.p. with high- and low-speed shafts and gear box for wing-submerged installations. The only illustration of this engine that has so far appeared shows it to be a design of altogether extraordinary ingenuity, the flattest engine the writer has ever seen. There is also a further report of a V-12 liquid-cooled Continental engine of about 2,000 h.p. in which the U.S. Army is interested.

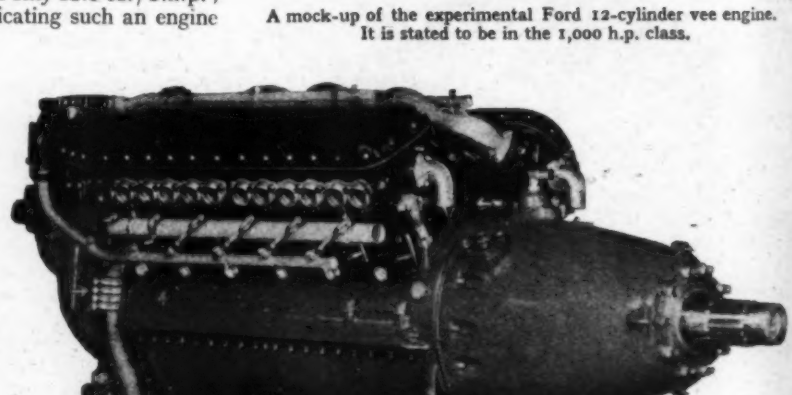
Ford: Readers of *Flight* are already well informed about the new V-12 Ford engine, which has the same displacement as the Rolls-Royce Merlin. The rated altitude of the Ford engine must surely be a record; 32,500ft. is well in excess of the maximum of 26,000ft. for the turbo-supercharged Junkers. Assuming that the take-off rating of 1,800 h.p. at 3,600 r.p.m. is actually established, this would give more than 6 b.h.p./sq. in. of piston area, and nearly 1.1 b.h.p. cu. in. of displacement, or 63 b.h.p. per litre.

POWER UNI

Lycoming: The 0.1230 liquid-cooled engine of this well-known firm has received a good deal of publicity, but the output of 1,200 h.p. at 3,400 r.p.m. appears to be altogether too modest for present-day requirements. The short stroke of this engine, 4¾in., results in a very reasonable piston speed of 2,691⅔ f.p.m. at max. r.p.m. In the low-power field



A mock-up of the experimental Ford 12-cylinder vee engine. It is stated to be in the 1,000 h.p. class.

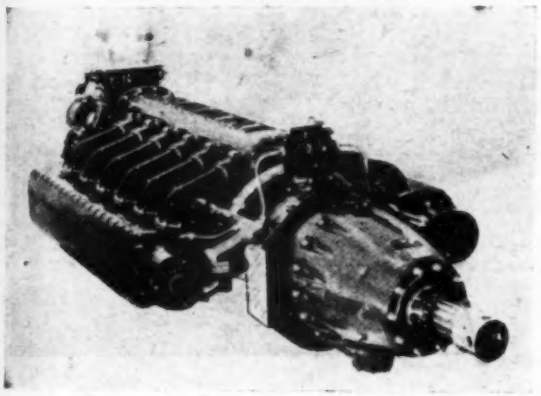


Allison V.1710-C15. The liquid-cooled 12-cylinder vee engine fitted to several of the American fighters. Rated at 1,040 h.p. at 3,000 r.p.m. at 14,300ft.

F THE FUTURE

Lycoming have developed the opposed six-cylinder air-cooled engine. The 435 cu. in. model develops 175 h.p. at 2,300 r.p.m. with direct drive and on 73-octane fuel. With a bore and stroke of $4\frac{7}{8}$in. × $3\frac{7}{8}$in., the max. piston speed is only 1,485 f.p.m. The long crank-arms of this engine are elliptical to cut down thickness and reduce the offset of the banks of three cylinders to a minimum; actually, the offset is only about 0.45 of the bore without any compensating connecting-rod offset. After the war the Flat 6 Lycoming and Franklin engines may be the most popular for light planes.

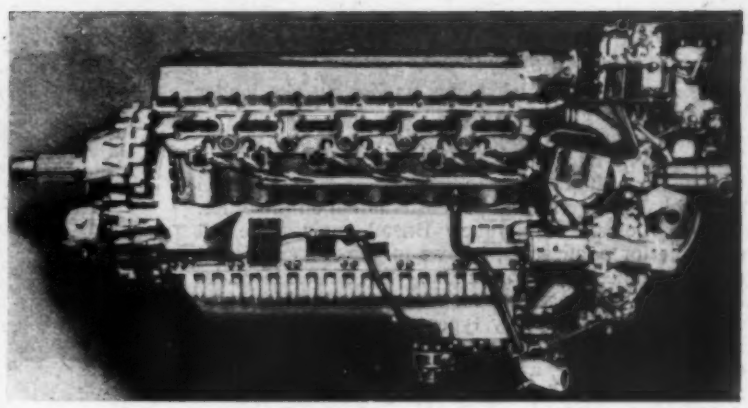
Packard: This famous firm has been producing V-12 engines for nearly 30 years. The 1,350 h.p. Packard marine petrol engine powers the American PT boats that have a speed of 70 m.p.h., and are similar to our own M.T.B.s. In addition, Packard are working on a 2,000 h.p. aircraft engine of their own design, probably a V-12.



Lycoming 0.1230. Horizontally opposed 12-cylinder engine with liquid cooling. Output is 1,200 h.p. for take-off at 3,400 r.p.m. Over-speed limit for diving, 3,720 r.p.m.

Outstanding among the new British designs is the X-24-cylinder liquid-cooled Rolls-Royce Vulture. Forerunner of the Vulture was very probably the design patented by the late Sir Henry Royce (then Mr. F. H. Royce) as long ago as 1925. The original engine had 16 cylinders in X form, but differed from the Napier Cub in that the angles between all the banks were 90 deg. Zero inertia torque variation was made possible with a special 5-bearing crankshaft with 135 deg. angles and side-by-side master connecting rods similar to those used in nearly all V-12 engines. However, it must have been early apparent that such an arrangement as this could not be tolerated in an X-24 liquid-cooled engine owing to the very great increase in crankshaft and block length that would result. The total block length in an X-24 engine is so great that to increase the inter-cylinder distance half an inch adds nearly a foot to the total block length.

A great deal of weight is normally saved in aircraft engines by pitching the cylinders very close together and cutting down the stroke/con.-rod ratio to about 1/1.7 as against 1/2 in a car engine. With inter-cylinder distances as low as $\frac{3}{4}$in., the length of the crankpin is naturally very limited, being normally about $2\frac{1}{4}$in. in an engine like the Rolls Peregrine with 5in. bore; there is only just sufficient space for one forked and one plain rod.



Rolls-Royce Peregrine. A 12-cylinder liquid-cooled vee engine with a power output of 885 h.p. at 3,000 r.p.m. at 15,000ft. from a capacity of 21⅓ litres.

It has been suggested that the problem ought to be simple enough; is it not just a case of using a master-rod and three link-rods? The answer is that where link-rods are normally used in radial engines, the available length for the crankpin is at least 50 per cent. greater than in a liquid-cooled engine of the same bore, and the master-rod is in one piece so that there are no connecting-rod bolts to take up space.

The Elusive "X"

Only those who have investigated the X-24 engine on the drawing board can have any real appreciation of the truly colossal job it must have been to get the Vulture into production and operational service; V-12 and H-24 engines are as nothing by comparison.

The Vulture has been described as two Merlins put together; it would be difficult to find a more irresponsible statement than this. The same writer went on to say that the displacement of this engine was 2,592 cubic inches, which is probably correct, and indicates that the bore and stroke are 5in. × $5\frac{1}{2}$in. and the volume in litres 42.47.

Disposition of auxiliaries on an engine of small fronted area is always a difficult proposition. In the case of the Vulture, drives for the camshafts and ignition system are taken from the front end of the crankshaft near the nodal point where the drive is smoother than at the rear.

The Rolls-Royce Peregrine is a very attractive little unit that might have been developed to give considerably more than 1,000 h.p.; the Whirlwind installation must surely be just about the cleanest there is. It will have been noted that even the air intake to the carburettor is absent, suggesting that air is ducted from the leading-edge of the wing to the carburettor as well as the wing-submerged cooling elements.

In discussing last year the trend of aircraft engine design Major Halford stated his preference for petrol injection, sleeve valves and exhaust-driven turbo-superchargers among other things. He asserted that the engine nacelle should be a minimum extension of the spinner diameter and generally concentric therewith. It will be remembered that Major Halford designed the Gipsy XII engine for the de Havilland Albatross; the very clean installa-

POWER UNITS OF THE FUTURE

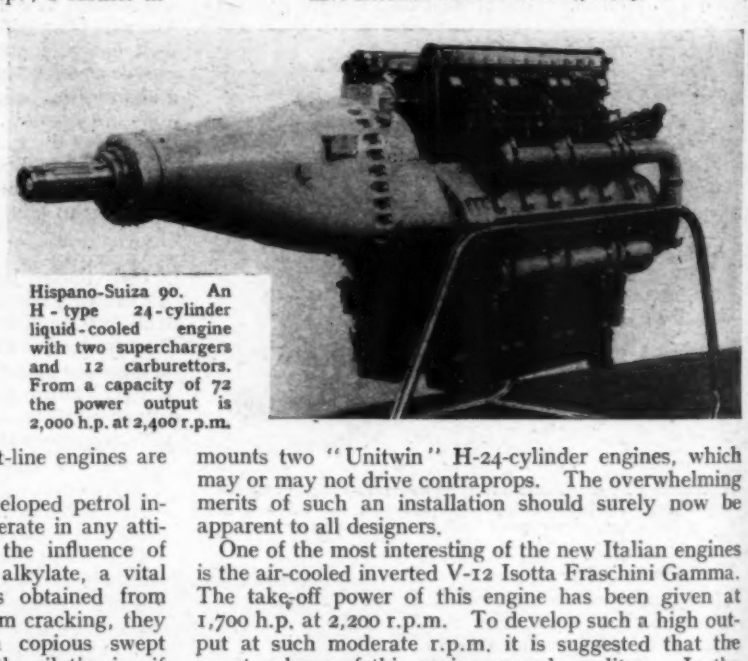
tion achieved with reverse-flow cooling speaks louder than words for Halford's dictum.

The H-24-cylinder Napier Sabre engine of 2,350 h.p. is likely to go into action soon and its performance will be watched with great interest on this side of the Channel and probably a great deal of consternation on the other.

No particulars of any new Bristol engines are yet available for publication, but we may rest assured that Sir Roy Fedden has not been idle. The Bristol Hercules has been in existence now for many years and is giving excellent service in many types of aircraft. Since the Stirling mounts either Hercules or Cyclone 14 engines of the same power, a definite appraisal of the relative merits of sleeve and poppet valves under similar conditions is now possible.

Before the fall of France, it was known that the French had a number of new engines in preparation, including a liquid-cooled 24-cylinder multi-bank (6 banks of 4 cylinders). There was also the opposed 16-cylinder liquid-cooled Bugatti engine reputedly suitable for wing-submerged installations. Recently, the design of the Hispano-Suiza V-12 engine has been brought up to date and the power stepped up to 1,500 h.p.; a further increase of power to 2,000 h.p. is anticipated for this engine, which has a displacement of 36.07 litres. The H-24-cylinder liquid-cooled Hispano of 72.14 litres originally rated at 2,400 h.p., may be increased to nearly 4,000 h.p. within the next few years.

Wright Double Row Cyclone GR.2600-A5B. A 14-cylinder air-cooled radial with two-speed supercharger. Take-off power 1,600 h.p. and 1,275 h.p. at 11,500ft. Later models have increased the take-off to 1,700 h.p.



Hispano-Suiza 90. An H-type 24-cylinder liquid-cooled engine with two superchargers and 12 carburettors. From a capacity of 72 the power output is 2,000 h.p. at 2,400 r.p.m.

A prominent Frenchman once said, "War is the National Industry of Germany." I do not think that there are many among us who are likely to quarrel with that statement. So it is that when the Germans design engines they design war engines pure and simple. Although the French developed the first *moteur* canon in 1918, a V-8 Hispano, the Germans got hold of the idea and I suppose that 95 per cent. of their first-line engines are of this class.

Again, with war in mind, they developed petrol injection so that their engines would operate in any attitude and would not cut out under the influence of negative *g*. Owing to their lack of alkylate, a vital ingredient of the higher-octane fuels obtained from natural gas or by-products of petroleum cracking, they concentrated on large engines with copious swept volumes which would tend to obstruct the pilot's view if mounted upright; the engines were therefore inverted. Finally, they standardised on a bore dimension of 150 mm. and cut out all "spit and polish."

German Claims

Germany now claims to be producing in large numbers the most powerful engine in the world, for which they also claim a very low specific fuel consumption; they further claim to be producing an entirely satisfactory exhaust turbo engine. The new German engine is almost certainly a Mercedes-Benz, possibly an H-24 of about 70 litres, developing perhaps 3,200 h.p.

The Heinkel 177 heavy bomber was until very recently thought to mount four Mercedes engines in two tandems, but the latest information suggests that the 177 actually mounts two "Unitwin" H-24-cylinder engines, which may or may not drive contraprops. The overwhelming merits of such an installation should surely now be apparent to all designers.

One of the most interesting of the new Italian engines is the air-cooled inverted V-12 Isotta Fraschini Gamma. The take-off power of this engine has been given at 1,700 h.p. at 2,200 r.p.m. To develop such a high output at such moderate r.p.m. it is suggested that the swept volume of this engine exceeds 50 litres. In the past, the Italians have used a bore dimension of as high as 175 mm.; with the most widely used bore/stroke ratio, the cylinder dimensions might well be: bore, 175 mm.; stroke, 192.5 mm.; displacement, 55.562 litres.

As previously mentioned, there are many advantages gained by designing an inverted V-12 engine; even with a displacement of 55½ litres, the Gamma engine appears eminently suitable for single-seat fighter installations or light attack bombers.

Both Russia and Japan are producing excellent engines from all reports. It is possible that Russia may shortly cease altogether from building foreign engines under licence, due to their now inadequate performance, and concentrate entirely on engines of Russian design.

POWER UNITS OF THE FUTURE

Examples of Japanese-built Pratt and Whitney Twin Wasp motors have been inspected by American technicians who state that the workmanship is of a high order, differing from American-built engines only in that the cylinder head fins are not pitched quite so close together.

Since the prevailing trend appears to be towards cylinders of the largest permissible dimensions, let us compare three hypothetical V-12 engines based on the Rolls-Royce RM2M 100-octane engine which had a take-off rating of 1,320 h.p. at 3,000 r.p.m.

Bore and stroke	5in. × 5.5in.	6in. × 6.6in.	7in. × 7.7in.
Volume	1,296 cu. in. (21.236 litre)	2,239½ cu. in. (36.696 litre)	3.556 cu. in. (58.272 litre)
Take-off power.	1,150 h.p. at 3,250 r.p.m.	1,600 h.p. at 2,750 r.p.m.	2,000 h.p. at 2,350 r.p.m.
Power per litre	54.14 h.p.	43.60 h.p.	34.30 h.p.
Power per cu. in. piston area ..	4.88 h.p.	4.71 h.p.	4.33 h.p.
Volume per cyl.	1.77 litres	3.06 litres	4.85 litres
Power per cyl. at take-off	95.8 h.p.	133⅓ h.p.	166⅔ h.p.

From the above figures it will be seen that there is very little difference between the outputs of Merlin and Peregrine engines operating on 100-octane fuel at similar piston speeds. Mr. Rodwell Banks has suggested that we might conceivably standardise on a bore dimension of 8in., and that the power obtained from an engine having 24 6in. × 6.6in. cylinders (73⅓ litres) may be as high as 5,000 h.p. at 15,000ft. in 1944 with 100-octane fuel; a similar engine having bore and stroke dimensions at 7in. × 7.7in. would then develop 6,250 h.p.

Personally, I am inclined to doubt the wisdom of designing such highly loaded engines, even if the above-mentioned ratings were made possible with 110-octane fuel. After considering a large number of very advanced installations for fighters, bombers, civil airliners and flying boats, there appears good reason to suppose that an output of 200 h.p. per cylinder for take-off is sufficient to meet most requirements. A suitable engine might have the following particulars:—

TYPE AND COOLING	H-24-cyl. liquid-cooled.
BORE AND STROKE	6¾in. × 6¾in. (158.7 mm. × 174.6 mm.).
C. TO C. DISTANCE BETWEEN CYLINDERS	7in.
SWEPT VOLUME.....	5,062.15 cu. in. (82.953 litres).
VOLUME PER CYLINDER ..	211 cu. in. (3.456 litres).
FUEL ANTI-KNOCK RATING	110.
TAKE-OFF POWER	4,800 b.h.p. at 2,950 r.p.m. (sea-level).
POWER PER LITRE	57.86 b.h.p.
PISTON AREA POWER	6.52 b.h.p. per sq. in.
MEAN PISTON SPEED	3,380 f.p.m. at 2,950 r.p.m.
DRY WEIGHT	4,200 lb.
SPECIFIC WEIGHT	1.4 oz. per b.h.p.

THE POSITION OF AIRCRAFT COMPANIES

THE annual general meeting of the De Havilland Aircraft Co., Ltd., was held on April 28th. The directors recommended the payment of a dividend of 10 per cent. £50,000 was placed to the Special Investment Reserve, and £10,000 to the Employees' Benefit Fund.

"Whilst unable to discuss our activities," Mr. A. S. Butler said, "I feel that I should touch upon our company's policy in these times. This policy has been to take on every task which would utilise our qualifications in the best interests of the nation, asking ourselves no question other than whether we could achieve it. The advance of design and the expansion of production have been the all-pervading motives of the board and management. In this total policy we have not allowed, and are not allowing, considerations of the company's future to influence our activities to-day, while it must not be forgotten, too, that the present method of taxation prevents us from making the reserves we would like against the uncertainty of the future. Industry will look to the understanding and vision of the Government when the time arises.

"I must record the board's appreciation of the untiring efforts given by all in our many works, and I wish on this occasion to pay a special tribute to our management and senior staff, who are bearing great responsibility. Managements are too easily and irresponsibly criticised in these times. The company's total policy and the wide field of our activities here and in our Dominion factories have entailed the stretching of our technical and organising capacity, and of our finances, almost to the limit, imposing the maximum load upon the shoulders of our experienced leaders. It is their task to organise our efforts, using their own initiative and knowledge, not relying solely upon Government leadership yet subject to Government regulation, never having all the factors under their control yet depended upon for a successful issue, not complaining of their lot yet always the fair game for the back-seat critic.

"In design they must exercise the far-reaching vision and judgment to keep the lead over the enemy, and the distant effect of their decisions is the measure of their responsibility and the mark of their success. In aircraft production particularly, unpredictable difficulties arising from an infinite variety of causes must be met with the keenest resourcefulness and urgency. In the finance connected with this, too, vigilance and responsibility are proportionate to the immense figures involved.

"These are not complaints or cries for help. But it must be realised that to maintain the highest pressure in industry is possible only if managements are given tolerances and understanding by men and women at the benches, by the Government and by the public as a whole.

"Our company expects nothing from our efforts beyond a better world in which to turn aviation to its human purpose when the time arrives."

[We feel that special attention should be called to this speech by the D.H. chairman because the case of that company is representative of numerous aircraft firms up and down the country. Criticism of management is handed out freely in the Press and in conversation. What is so often overlooked by these critics is the fact that aircraft companies are perforce building up huge organisations for which they assume responsibility. Yet the system of taxation is such that not only is it not possible for them to make large profits but, much more important, they are unable to set aside reserves needed for taking care of the post-war reduction and reorganisation which will be needed to place the business on a commercial basis when the war is over.

Mr. Butler was careful to point out that he was not making complaints nor uttering cries for help. But the public should be taught to appreciate the position, and it is hoped that our leaders will take to heart Mr. Butler's comment: "Industry will look to the understanding and vision of the Government when the time arises."—ED.]

The R.A.F. WORKS SERVICES

PUTTING UP A NEW HANGAR: The steel erectors at work are partly airmen of the R.A.F. Works Services and partly employees of the civil contractor.

Civil Engineering Branch : Airmen With Building Trades Experience Can be Remustered

By MAJOR F. A. de V. ROBERTSON, V.D.

(Illustrated by "Flight" photographs.)

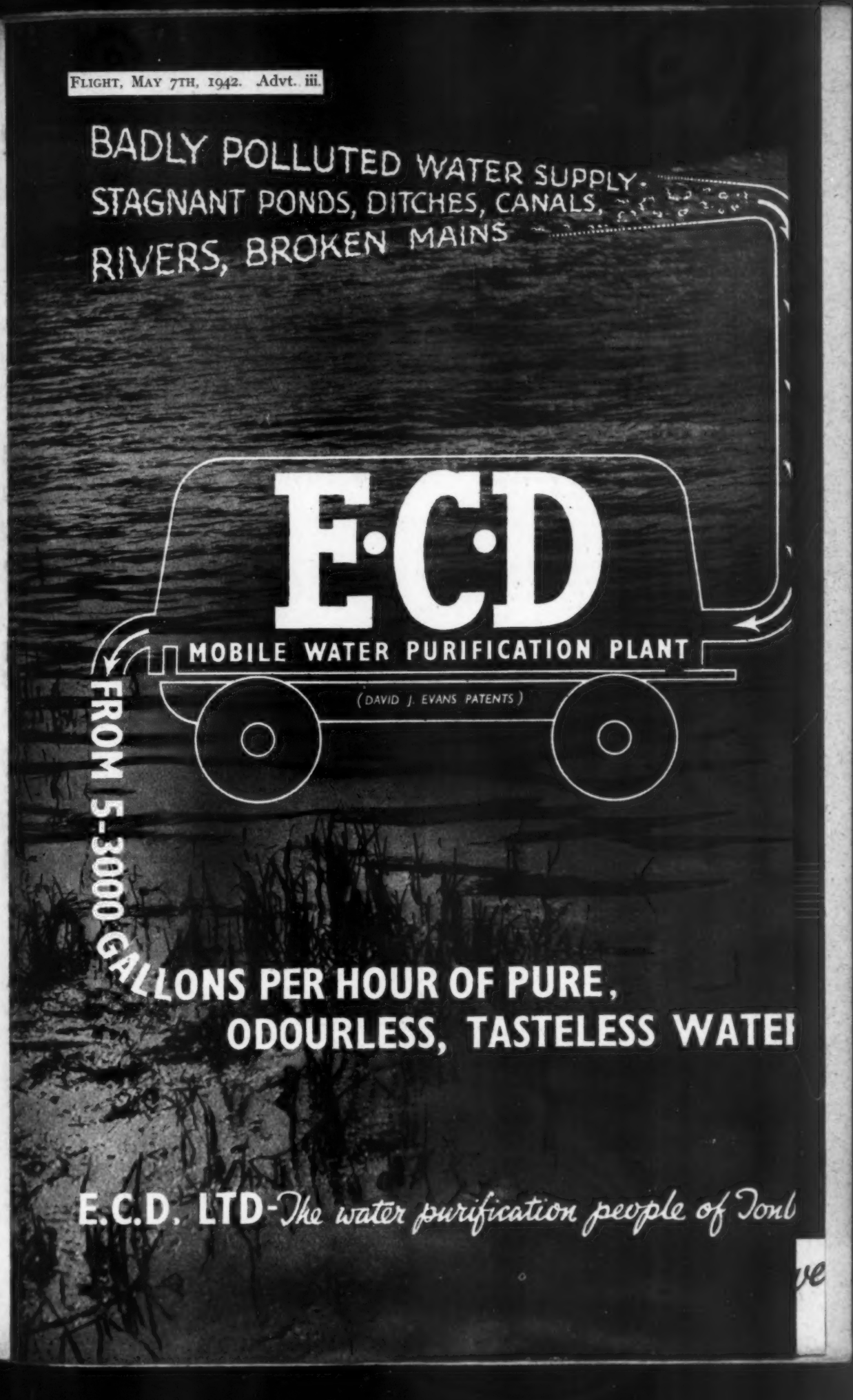
IF a census were to be taken to find out how many people, either inside the Royal Air Force or among those who contemplate joining it, are aware that the Service possesses a civil engineering branch, the degree of ignorance disclosed would probably be surprising. It is even doubtful whether full information about the subject is available at all recruiting centres. Nobody seems to deserve blame for this ignorance, for the Air Ministry has circularised R.A.F. stations, giving information about its Works Services, but such circulars do not always get home to those who might be concerned. The fact remains that various airmen, who in civil life have earned their living in public works or building services, have been found working in quite different trades, and thereby not doing the best that they could do to help on the country's war effort.

Such men when taken by the Army are probably sent to the Royal Engineers, and if by the Navy to the Royal Marines; but it has happened that a man accepted by the R.A.F. who has said that he was by trade a concretor or a bricklayer, has been told that there were no such trades in the R.A.F. and has found himself converted into a cook or a motor cycle despatch rider, or something equally alien to his trained abilities.

The Royal Air Force Works Services came into being in February, 1941, and it operates under the direction of the Air Ministry Works Directorate, which department is staffed by civilians. The A.M.W.D. is responsible for the erection of new R.A.F. stations, the levelling of flying fields and other work in the same category. It arranges the contracts and often supplies the materials, unless the civilian contractor undertakes to do so.

The question may be asked why, if the majority of such

SCHOOL FOR WORKS SERVICES AIRMEN: A civilian instructor explaining the working of a caterpillar tractor equipped with hydraulic angledozer.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THE R.A.F. WORKS SERVICES

work is done by civilian contractors, it is necessary for the R.A.F. to have a civil engineering branch of its own. One answer is that the R.A.F. Works Services form a valuable (sometimes invaluable) reserve for an emergency.

The whole country is short of man-power just now, and contractors often come to the Works Services and ask for so many men to help with a certain job. It is a great convenience if they can be supplied. An even stronger case occurs if a station is bombed and damage done to buildings and the flying field. Then, if there are R.A.F.W.S. men on the station, they can get to work at once, filling in the craters and levelling the ground, repairing damaged buildings, drains, water supply and electricity supply in the buildings.

The Works Squadrons

This, of course, is emergency work. Normally the Works Services are not under the orders of a station commander. At each station there is a civilian clerk of the works, who is the representative of the Air Ministry Works Department. He decides whether a certain job of work shall be put in hand at once as an emergency measure or whether it must be referred to the Air Ministry.

The R.A.F.W.S. are organised in so many Works Squadrons, in different parts of the country, and each squadron has one Squadron Leader, one adjutant, three Flight Lieutenants or junior officers doing the duty of Flight Lieutenants, and ten Warrant Officers. The last-named are naturally highly qualified men, and their capabilities make it possible for a squadron to work with such a small establishment of commissioned officers.

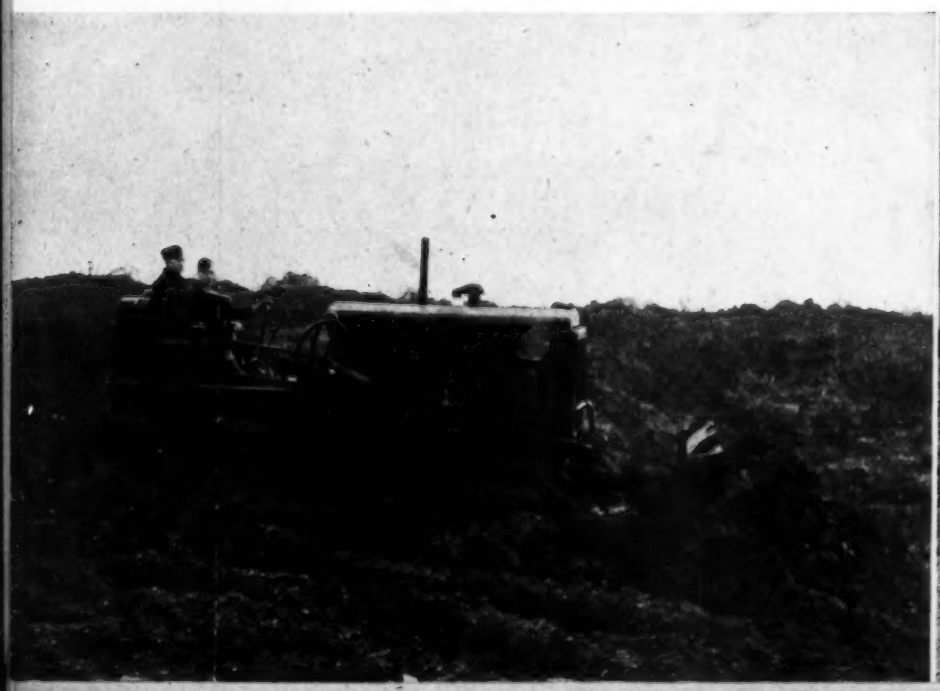
The trades recognised in the R.A.F.W.S. are: Carpenter, bricklayer, plumber, works electrician (not to be confused with aircraft electrician), steel erector, concretor, drain layer, groundsman, blacksmith, and plant-operator (i.e., operator of caterpillar vehicles and allied equipment). Foremen of trades and general foremen are emphatically desirable, and are always given N.C.O. rank. In addition, some other R.A.F. tradesmen are employed by R.A.F.W.S., such as clerks and motor transport drivers, but they do not need to be specially recruited or remustered.

The Works Services train only a very small percentage of their men. There would not be time for them to do so, unless the war goes on very much longer than any of us would care to contemplate. For instance, when I visited one of the Works Squadrons I learnt, much to my surprise, that in civil life it takes four years before a bricklayer can earn

"Total war does not mean total misery," said Mr. Morrison. This the

Airmen making a drain for an officers' quarters.

LEVELLING A NEW AIRFIELD: A caterpillar tractor equipped with hydraulic angledozer filling in a hollow.



MAKING A NEW AIRFIELD obliterating an old road wh

rison. This theatre has been constructed by Works Services airmen in an old hangar.

Nissen huts being erected on brick foundations by airmen.

full wages, and there are varying periods for training in other trades, none less than a year.

The plant-operators are sent to a school (as was recorded in the issue of *Flight* dated October 9th, 1941) run by Jack Olding & Co., Ltd., to learn all about caterpillar vehicles. Most of the men come to R.A.F.W.S. qualified by their experience in civil life, and so it is important that all airmen with public works experience should know that they can apply to be remustered into any of the above-mentioned trades for which they are qualified. It is also important that such men when joining the R.A.F. should know that they can carry on their work in their own trades while wearing the honoured uniform of the Royal Air Force.

Square Pegs Sorted Out

A few typical instances may be given. I met one flight sergeant wearing the medal ribbons of the last war, who is doing fine work in the R.A.F.W.S. He was in civil life a contractor's general foreman, but he spent his first months in the R.A.F. in the Maintenance Command, working on aircraft salvage. He was probably quite useful in that employment, but now he is doing work for which he is highly qualified, and is therefore of still more use to his country.

One aircraftman second class applied to be remustered to R.A.F.W.S. When questioned, it turned out that his civil trade was some form of public works, that in the last war he had been a quartermaster sergeant, and in the inter-war years a company sergeant major in the Territorial Army. He was remustered, speedily promoted to sergeant, and is now up for promotion to flight sergeant. With his experience there is no saying where he will rise to by the end of the war.

Another A/C.2 applied for remustering and was found to be a civil engineer who had been the agent for the construction of two airfields, with runways, etc. Naturally he was promptly accepted, and was shortly granted a commission. Another aircraftman had been an architectural assistant and is now a flight sergeant. An assistant to a county architect was found, holding the rank of sergeant, in some other branch of the R.A.F. He had never heard of the Works Services, and was only discovered by chance. When he heard about it he promptly applied to be remustered, and his application went through.

There must still be men in the R.A.F. whose civilian employment has been in one of the trades mentioned above. If so, it is hoped that this issue of *Flight* will come into their hands, and will bring them the information that, though they are doubtless already doing good service, there is an opportunity for them to work for the country's war effort to still better effect.

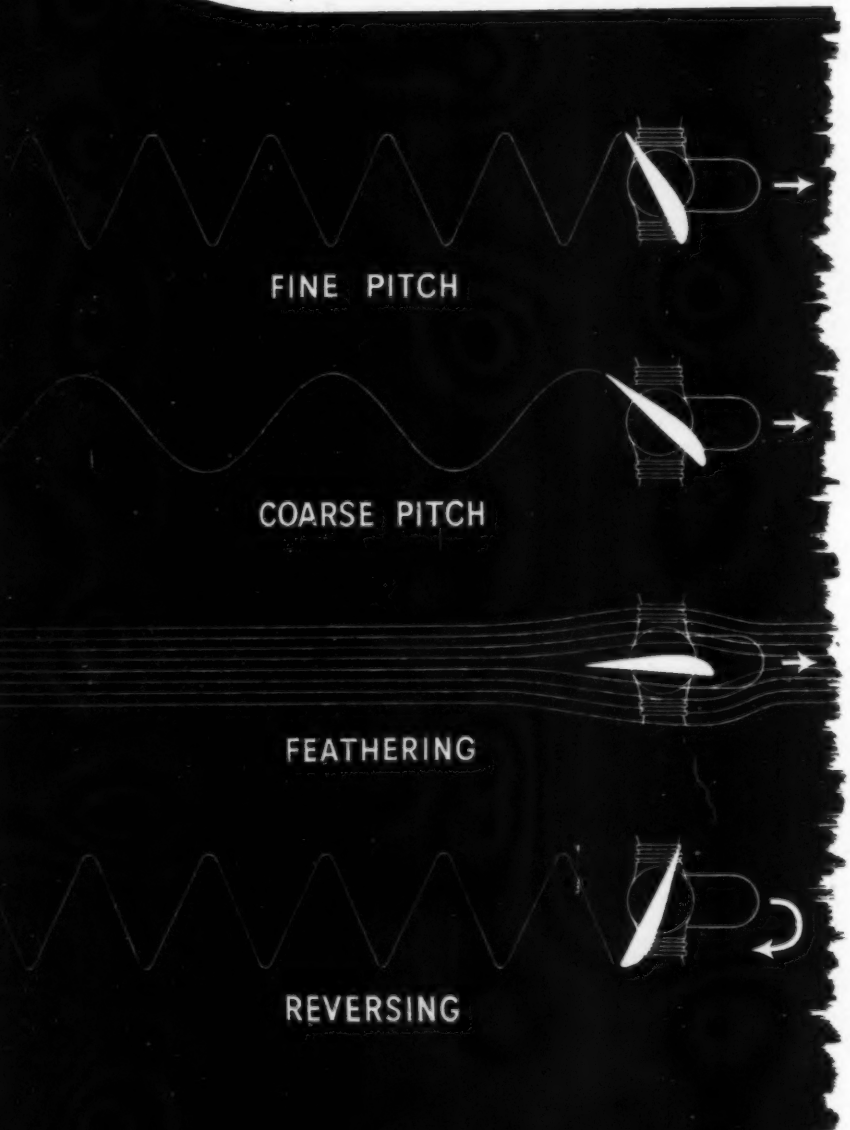
EW AIRFIELD: Works Services airmen n old road which ran across the fields.

Airmen of the R.A.F. Works Services helping to build a new camp. An officer and a flight sergeant watch a mixer at work.

ROTOL

VARIABLE PITCH

HYDRAULIC AND ELECTRIC PROPELLERS



Give Generously to the R·A·F BENEVOLENT FUND

WORLD PRESS SUMMARY

RÉSUMÉ OF TECHNICAL ARTICLES DEALING WITH AIRCRAFT AND ASSOCIATED SUBJECTS

For the summaries and translations from aircraft and technical journals of the world, we are indebted to the Directorate of Scientific Research and Technical Development, Ministry of Aircraft Production.

Bomb Fires in Italy

THIS article is a German abstract of a report issued by the Italian Ministry of the Interior covering fires which have occurred throughout Italy during 1940. It appears that over the latter half of that year, 444 fires were due to enemy action (incendiary bombs). Of this total, 192 occurred in Mailand, 50 in Turin, and 30 in Naples. The Italian official report emphasised that the damage due to fire greatly exceeded that due to explosive bombs, and the best method of reducing danger due to incendiaries is to attack the fire as soon as possible, besides ensuring that the storing of inflammable material is under strict control.

The total number of fires from all causes is given as 6,000, involving a loss of 180 million lire. The loss due to incendiaries (444 fires) is given as 15 million lire.

The original report also contains statistics of other bomb damage and it is stated that the losses incurred are on a moderate scale.

Official Statistics on Fires Due to Enemy Action in Italy During 1940.—P.Z. Korrespondenz (A.R.P. News.) (Italy.)

Instrument Lights

BEFORE the aircraft pilot is a score or more of indicator lights. If they are bright enough to be clearly distinguished as on or off during a bright day they will blind him at night if he shifts his gaze from the inky blackness outside to the cockpit. One remedy has been to control the brilliance by inserting resistance into the circuit, but this has required rheostats as bulky and heavy as the lamps themselves.

A method of brilliance control developed by Westinghouse adds neither weight nor bulk to a crowded instrument or radio-control board. Two layers of Polaroid screen are placed between the bulb and the lens; one is fixed in position, the other can be rotated by turning the lens. The stationary Polaroid screen polarises the light in the horizontal direction; it blocks all light waves from the lamp except the horizontal. The rotatable Polaroid can be oriented to allow the horizontally polarised light to come through or, when turned 90 degrees, to block them. Thus the pilot can obtain from the indicator light any brilliance from full brightness to almost complete darkness by simply rotating a collar on the indicator.

Brilliance Control of Aircraft Instrument Lights.—(J. Aeron. Sci. (Rev. Sect.) (U.S.A.))

American Gliders

THE following details have become available of a number of gliders and sailplanes ordered by the U.S. Army Air Forces and the Naval Air Service: XTG-1, two-seater training sailplane built for the U.S. Army Air Forces by the Frankfort Sailplane Co., of Joliet, Ill.: Span 46ft., length 24ft., gross weight 790lb. XTG-2, two-seater training sailplane, built for the U.S. Army Air Forces by the Schweitzer Aircraft Corp., of Elmira, N.Y.: Span 52ft., length 25ft., gross weight 860lb. Troop transport glider, built for the naval air service by the Allied Aviation Corp., of Baltimore, Md.: Span 88ft., capacity 12 men, gross weight 6,500lb., plywood construction. Troop transport glider, built for the naval air service by Snead and Co., of Orange, Va.: Span 110ft., capacity 24 men, gross weight 12,000lb.; plywood construction. In this connection the American source mentions an unconfirmed report according to which the German Air Force has at its disposal gliders with a span of 140ft. and carrying a far larger number of troops than the 15-man gliders previously employed, which are stated to have a span of 90ft.

Glider Development in the U.S.A. (*Inter Avia.*) (U.S.A.)

Simplified Control

PROBLEMS of control are presented from a standpoint of simple operation rather than mere mechanical simplicity. Of first importance is the elimination of inconsistent or abnormal behaviour, in which spinning is classed. The influence of wing and engine position is discussed, and several advantages of car type of wheel arrangement brought out.

A primary control, in which flaps are co-ordinated with elevator, and rudder with ailerons, is advocated. In a possible supplementary pedal control, ground brakes are co-ordinated with air drag obtained by opposite deflection of two rudder surfaces.

Special problems, considered from a standpoint of simplified control, include stability against overturning on the ground, inertia loads on the wing, spiral stability, and control requirements for following a compass course.

The ideal aircraft for private flying is described as being: outstanding in vision, incapable of spinning, comparable with car in simplicity of control, yet with unquestioned superiority of cross-country performance.

New Developments in Simplified Control. (R. H. Upson, Inst. Aeron. Sci. (U.S.A.)

Portable Runways

THE flight strips consist of portable metal "mats" with which the entire landing area is covered and which, without additional treatment of the ground covered, offer a bearing strength sufficient for normal bomber aeroplanes. These metal mats, so-called "Marston Strips" (named after the initial installation in North Carolina), consist of stamped steel panels measuring one-eighth inch in thickness, are provided with interlocking members along their sides and with two reinforcing longitudinal corrugations; in order to save weight, holes measuring 2½in. in diameter are punched out. The individual strips are 10ft. long and 16in. wide, and are secured by spring clips against longitudinal movement after being laid down. The weight of each strip amounts to about 65lb. The normal size of each landing ramp has been fixed at 150ft. by 3,000ft.; for such an area considerably more than 30,000 separate panels will therefore be needed, and the total weight of the entire ramp would exceed 1,100 short tons. The experiences so far made with this metal mat have shown a bearing strength corresponding to a concrete layer of about 4in.; very satisfactory results are stated to have been obtained as regards grip and tyre wear. The steel ramp can easily be camouflaged by painting or by sowing grass, etc.

Flight Strips for Emergency Landing Grounds.—(*Inter Avia.*) (U.S.A.)

A.A. Gun-firing Errors

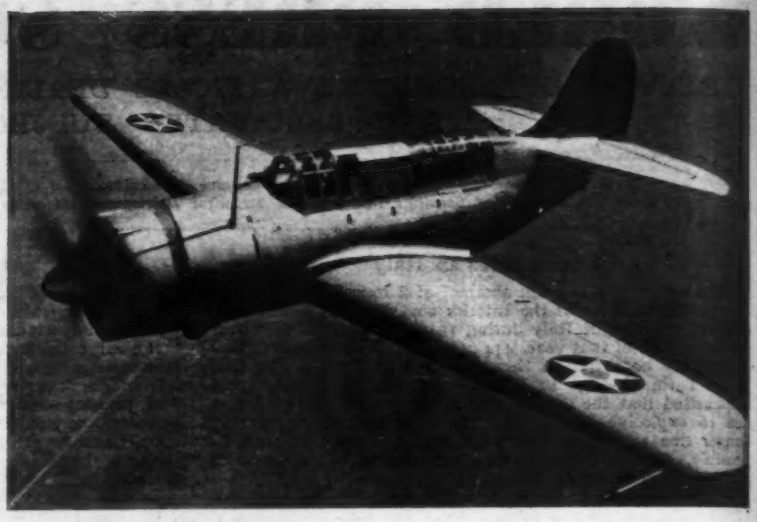
SMALL-CALIBRE guns use contact fuse ammunition and the firing error is thus determined by the distance between target and shell when the latter passes through the target plane (containing flight path of target and perpendicular to shortest distance from gun).

The problem is therefore to determine the instant the tracer ammunition passes through this plane, and for this purpose the author suggests observation of the trail at a definite time interval after firing the gun. This interval corresponds to the time of flight of the shell for the target distance as measured by the range-finder. It is stated that the method is much simpler and more accurate than the usual procedure of estimating passage of trail through target planes by purely stereoscopic means.

Examination of Firing Errors in the Case of Small-calibre Anti-aircraft Guns. (H. Donatsch, *Flugwehr und Technik.* (Switzerland.)

A 1,700 H.P. DIVE BOMBER

The Curtiss "Helldiver," Claimed to be the Most Powerful in Its Class



The new Curtiss "Helldiver," claimed to be the world's most powerful dive bomber, has been designed for operation from American aircraft carriers. The bomb load is carried internally, so that some form of ejector bomb rack must be fitted.

THE Curtiss-Wright Corporation in America has just completed a new dive bomber for the U.S. Navy. It is claimed that it will transport a larger bomb load at a higher speed for greater distances than any dive bomber ever developed in America or elsewhere, and will greatly extend the striking power of the U.S. Navy's battle fleet.

The new dive bomber, designated the Curtiss "Helldiver" (SB2C-1 dive bomber) is a two-seater, all-metal monoplane, designed by Curtiss-Wright Corporation's Airplane Division, of Buffalo, N.Y., in response to the U.S. Navy's demand for a diving scout bomber which will out-perform any other machine of its type in existence.

Designed to operate from aircraft carriers on extended scouting and bombing missions, it has a 1,700 h.p. Wright Cyclone engine which assures it exceptional performance and reserve of power. It is equipped with a three-bladed electrically operated fully feathering airscrew.

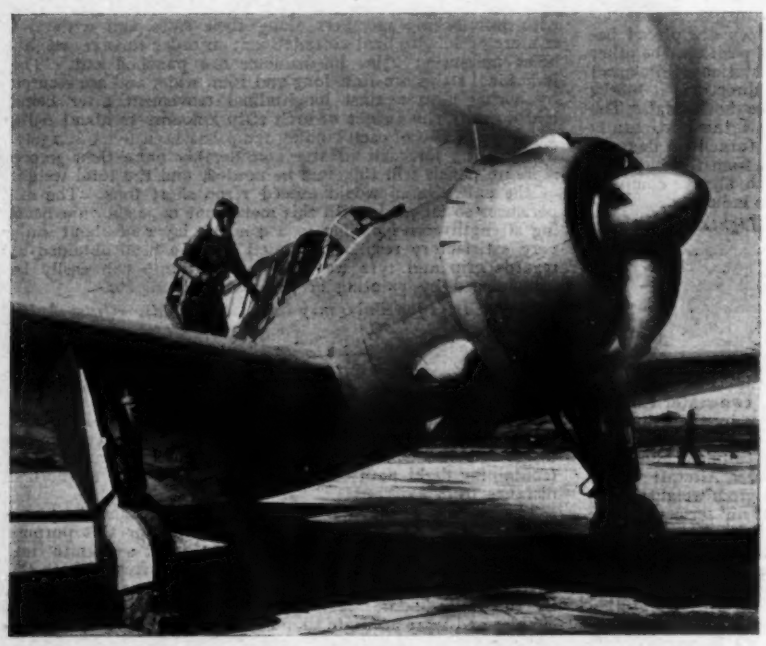
Something "Super"

The U.S. Navy wanted a "super" dive bomber that could carry twice as many heavy bombs as any existing dive bomber; fly twice as far as present models to protect America and its fleet 600 miles farther away than previously; remain in flight 4½ hours longer, and attain a maximum speed 100 m.p.h. faster than current types; double the existing armament, thus achieving greater fire power than any other single-engined naval aircraft, and incorporate many mechanical improvements.

The new Curtiss "Helldiver" is claimed to fulfil all these requirements. It also incorporates numerous new features in naval aircraft design. These include unusually heavy armament; provision for carrying the bomb load inside instead of outside the fuselage, thus eliminating its drag; wings that fold upward to facilitate storage on shipboard; wing slots that make the machine very manœuvrable even at the low speeds used in landing on an aircraft carrier deck; and flying controls that are operated hydraulically instead of mechanically.

The new Curtiss "Helldiver" is designed for rapid production. It is scheduled for production in the organisation's mammoth £3,500,000 plant of 29 acres recently completed at Port Columbus, Columbus, Ohio, which employs 13,000 workers.

The Wright Cyclone fitted in the "Helldiver" is a 14-cylinder, air-cooled radial, which gives 1,700 h.p. for take-off at 2,500 r.p.m. It has a two-speed blower, the ratios being 7.06 : 1 and 10.02 : 1. The rated power of 1,700 is developed, with the blower in the low ratio, at the same r.p.m. at 4,100ft., and in high gear the power is 1,450 h.p. at 14,100ft. and 2,500 r.p.m. The engine is, of course, run on 100-octane fuel. It weighs 1,980 lb.



The Wright Cyclone, of 1,700 h.p., is housed in a long-chord cowl with cooling gills at the back. The size of the man on the wing indicates that the "Helldiver" is by no means a small aircraft. The wings fold upwards for stowage on board a carrier.

Thirty-seventh of the Second Series

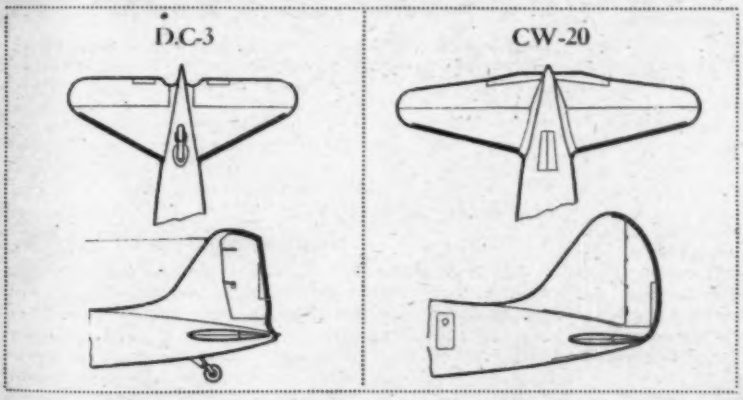
FRIEND or FOE?

Two American Transports : D.C-3 and CW-20

DOUGLAS D.C-3. Broad apex to fin and rudder and straight trailing-edge above pointed tail of fuselage. Pronounced backsweep to leading-edge of tailplane. Fixed tail wheel.

CONCENTRATION on military types of aircraft is apt to cause the civil transport type to be overlooked, yet it comes just as much within the purview of the spotter as its more aggressive companions; there are many of them doing valuable service in this country and in other theatres of war.

This week we deal with two well-known American types of twin-engined transport, the Douglas D.C-3 and the Curtiss-Wright CW-20, which



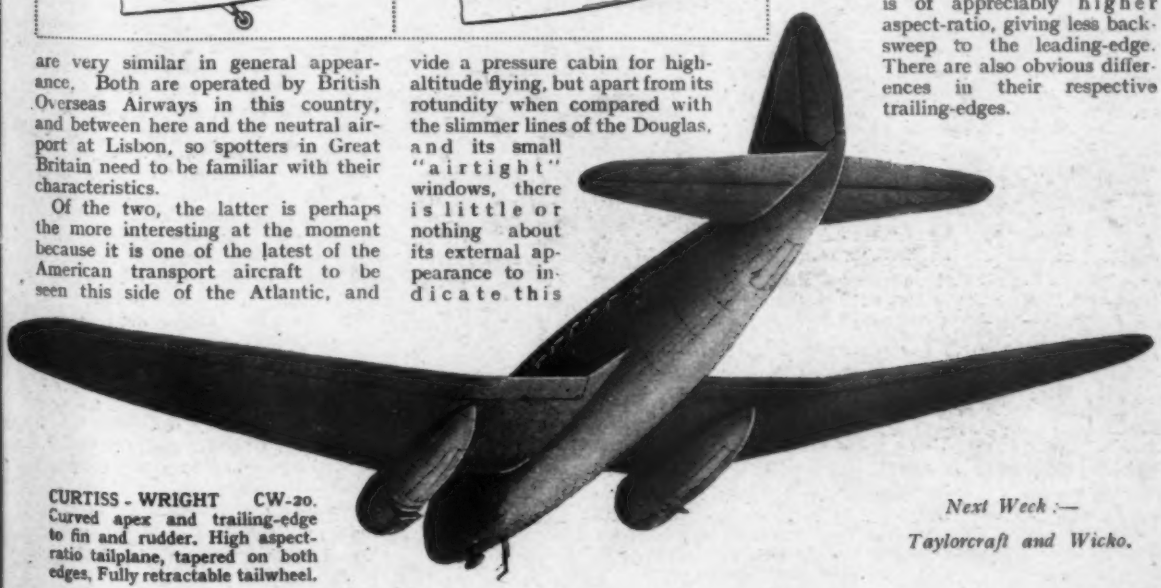
are very similar in general appearance. Both are operated by British Overseas Airways in this country, and between here and the neutral airport at Lisbon, so spotters in Great Britain need to be familiar with their characteristics.

Of the two, the latter is perhaps the more interesting at the moment because it is one of the latest of the American transport aircraft to be seen this side of the Atlantic, and readers of *Flight* will remember that the first of its type to arrive here was described in these pages not very long ago. This was the *St. Louis*, which was flown across the Atlantic fitted with extra fuel tanks in the forward part of the passenger cabin.

The fuselage was designed to provide a pressure cabin for high-altitude flying, but apart from its rotundity when compared with the slimmer lines of the Douglas, and its small "airtight" windows, there is little or nothing about its external appearance to indicate this special feature. In any case, it was not required when B.O.A. took it over, and the pressure equipment had been removed.

Two easily spotted differences in the tail assemblies of the D.C-3 and the CW-20 provide quick clues to their respective identities. The first is that the former has a fixed tail wheel, whereas that of the latter is fully retractable, and the second is the shape of their fuselage extremities; that of the Douglas forms a point jutting out from below the rudder, while that of the CW-20 blends smoothly into the trailing-edge of the rudder to form a continuous curve.

The marked difference in contour of the respective fins and rudders is clearly shown in the small drawings, while as regards their tailplanes, it will be seen that that of the CW-20 is of appreciably higher aspect-ratio, giving less backsweep to the leading-edge. There are also obvious differences in their respective trailing-edges.



CURTISS-WRIGHT CW-20. Curved apex and trailing-edge to fin and rudder. High aspect-ratio tailplane, tapered on both edges. Fully retractable tailwheel.

Next Week :—

Taylorcraft and Wicko.

... — — — ...

EMERGENCY RADIO

Details of Two German Types of "Notsender": The N.S.1 Used from Land, the N.S.2 from Dinghies

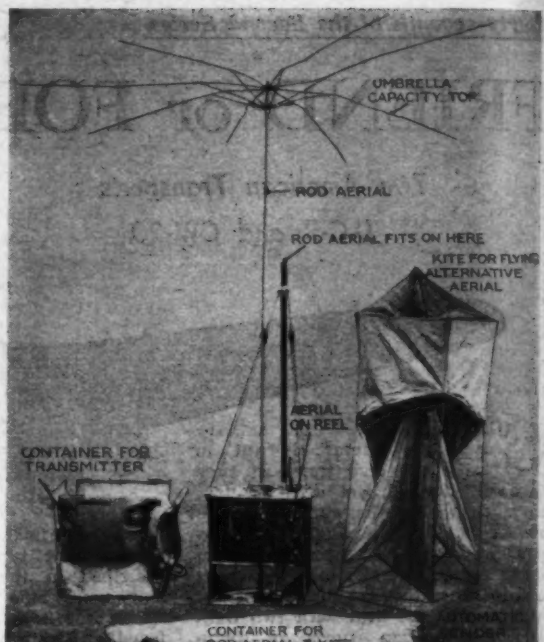
IN the issue of *Flight* dated December 11th, 1941, we published a critical report by Mr. William P. Lear, the well-known American designer of aircraft radio apparatus, on the wireless equipment of a Messerschmitt Me 109. Mr. Lear was not greatly impressed, and said that German aircraft radio design was obsolescent, having apparently been "frozen" in 1933 or so. That view confirmed the opinion of British experts, who considered workmanship good, but design not very advanced.

Since that time Government experts have had an opportunity to examine and test thoroughly a number of outfits from captured enemy aircraft, and the Ministry of Aircraft Production has granted us permission to quote from some of the reports by these experts. The equipment of the Heinkel He lllH is taken as typical of the fully equipped classes of aircraft and comprises long and short wave radio communication circuits operating on four fixed frequencies, blind-approach equipment, D.F. equipment, and intercommunication circuits. The comment of the experts is that the system is an easily-operated and well-planned one, and that technically the radio design is sound but not advanced. The mechanical design and workmanship are good, but the design heavy and expensive. The weight of the complete equipment is about 360 lb. The equipment is exceptionally easy to service and repair. The maximum power consumed is 550 watts from a 24-volt battery. The equipment of the He lllH is of the Funk Gerät 10 type, abbreviated to Fug 10.

German aircraft types such as the Ju 87 dive bomber and the Me 109 fighter carry much less ambitious equipment of the Fug 7 type.

Special interest attaches, so far as this journal is concerned, to two types of emergency transmitters carried in German aircraft. The German word for such a transmitter is *Notsender*, and details are available of two types, the N.S.1 for use from land, and the N.S.2, used from dinghies.

The N.S.1 (from a Heinkel He lll) is a self-contained portable transmitter capable of C.W. transmission either by hand-keying or automatic sending. On automatic sending it transmits SOS three times and then a long dash and then repeats.



The "Notsender N.S.1" is carried on German aircraft and used for emergency transmission when an aircraft has alighted on land.

The frequency coverage is 320 to 532 kc/s. Tuned for spot frequency 500 kc/s.

Weatherproof

The transmitter measures about 18in. by 10in. by 18in. high. All necessary switches are on top panel, the whole practically weatherproof and would stand immersion in sea water for short period. The whole exterior is painted bright yellow and simple instructions are given for operation; the meter, etc., is painted with luminous paint.

The frequency is preset and only aerial tuning and switching is available on outside. The weight about 50 lb.

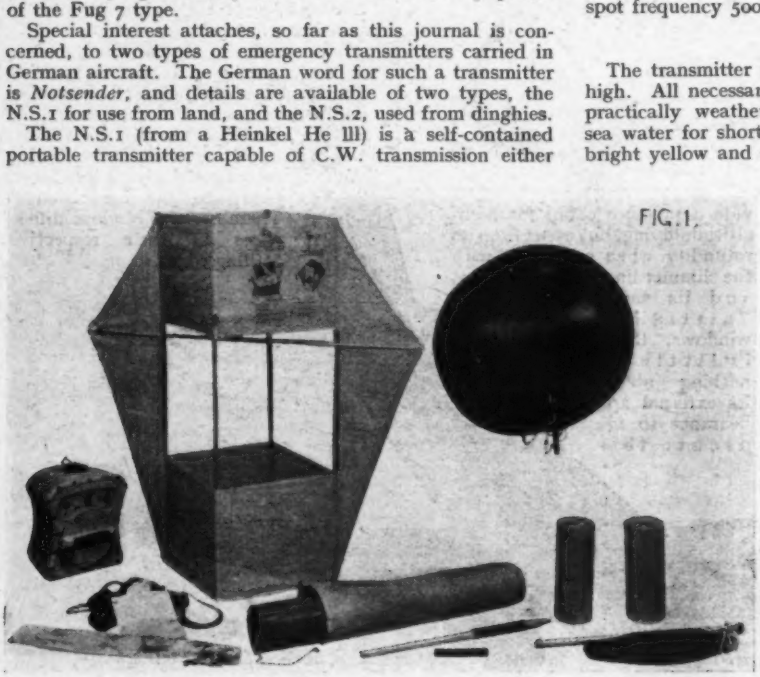
Aerials are in separate container which is similar to an aluminium golf club bag. One aerial is five sections of aluminium tube—total length 5 metres, with "umbrella" capacity top. The other aerial is 165ft. of standard steel wire and is wound out from a reel in the transmitter and flown on a box kite stowed in the aerial container.

The tube aerial is supported direct in a socket on the transmitter and stayed with four small guys to the top of the transmitter, and other guys can be attached to the top of the transmitter and thence to the ground or sides of a dinghy.

The transmitter consists of two parts:—

(a) The transmitter chassis type S.210.

FIG. 1.



The N.S.2 is a dinghy outfit in which the aerial can be lifted either by a kite—if the wind is strong enough—or by a balloon.

EMERGENCY RADIO

(b) Ancillary equipment consisting of
480 volts H.T. supply made up of four 120-volt dry batteries.
4-volt accumulators for filaments, etc.
Aerial reel with 165ft. of aerial wire.
Automatic sender capable of sending SOS three times, followed by long dash and then repeating, which would enable D/F bearings to be taken on the transmitter.

The dinghy transmitter (Notsender N.S.2) is carried loose in the aircraft and consists of two parts, the transmitter and the accessory container (see Fig. 1), both of which are watertight, buoyant and painted a bright yellow.

The transmitter and hand generator are housed in an aluminium alloy box approximately 11in. by 10in. by 7½in. and weigh 15 lb. The light alloy accessories container is 24in. by 8in. by 5in. and weighs 12 lb. This holds a kite, two balloons with filling tubes, two hydrogen generators and an instruction booklet.

In an emergency the crew inflate their dinghy and pull in the radio apparatus by the tarred rope which is attached to facilitate its transference to the dinghy.

If the wind is more than 15 m.p.h. the kite, which is of the box type, is extracted and erected according to the instructions contained in the booklet. The aerial wire, which consists of 260ft. of stainless steel wire, is attached by the special hook provided, and reeled out until the kite reaches a suitable height. Ten feet of stainless steel wire terminating in a sinker form the earth wire and this is lowered over the side of the dinghy.

When there is little or no wind, i.e., less than 13 m.p.h., the balloons may be used to raise the aerial wire. These are inflated by taking one of the hydrogen generators and opening the top by pulling the opener provided. The tube to which the balloon is attached, is then screwed in and the can immersed in water to a depth of 12 inches; an insulated grip is provided as considerable heat is generated. When the balloon is inflated to a diameter of one metre, it may be detached from the tube and any water which has accumulated at the bottom syphoned away by manipulating the clip. The aerial wire is then fixed to the cords provided and raises the antenna.

One of the crew now holds the transmitter (see Fig. 2) between his knees (it is specially shaped for this purpose), inserts the handle for the hand generator and turns at approximately two revolutions per second. After the brief warming up period, the aerial condenser may be tuned for maximum brilliance in the neon indicator and the selector switch turned to either automatic or hand keying on M.C.W. or C.W.

The N.S.2 transmitter dismantled to show its component parts.

The N.S.2 transmitter is so shaped that it can be held between the knees while the power is generated by turning the handle on top of the case.

The mechanical construction of the transmitter has several interesting features; among these is the use of the top panel as the mounting plate for all the components. No sub-chassis is used. The general layout of the components may be seen in Fig. 3, where it will be observed that when the two pieces are fitted together the necessary supplies are transferred from the hand generator by a five-pin plug and socket. A rubber gland between the two sections makes the whole watertight, and when the handle of the generator is stowed in the rear of the case a small cap which is normally attached by a leather thong is screwed in to prevent the entrance of any water at this point.

The automatic sender consists of a step-by-step motor and camshaft and a control unit containing an electrically maintained balance wheel oscillating at dot frequency. Contacts on the control unit operate the driving magnet of the step-by-step motor, the speed of operation being practically independent of supply voltage variations. A moulded bakelite cam mounted on the camshaft carries a series of depressions operating the keying contacts. The transmitter then radiates S.O.S. and long dashes in either C.W. or M.C.W., provided the selector switch is in the automatic sender position.

When a radio operator is available, the hand key may be used to transmit messages other than the conventional S.O.S.

The hand generator is a two-pole wound field type with two commutators and has a voltage regulator which operates on the shunt field. The handle is secured by a left-hand bolt and when not in use is secured in a space left for the purpose in the rear of the transmitter.

The consumption figures are as follows: L.T. 4 volts 1.7 amps. on M.C.W. and 1.55 amps. on C.W. operation; H.T. 325 volts 75 mA on M.C.W. and 65 mA on C.W. operation.

The estimated range over sea giving 10 microvolts per metre will be 250 miles. Estimated range over land giving 10 microvolts per metre will be 120 miles.

In tests, maximum range over land giving good D.F. bearings was found to be 120 miles, but signals were audible as far as 160 miles.

IN PARLIAMENT

Service Officers on Combined Operations Staff : No Away Matches for R.A.F. at Easter : Development of the Helicopter : A.T.C. Appeals for Funds : Delays in Aircraft Factories : An Inappropriate Symbol : Sunday Shows in Belfast

Combined Operations Staff

Wing-Commander Hulbert asked the Prime Minister how many officers in the Combined Operations Staff hold commissions in all three Services?

Mr. Attlee : With the exception of the Chief of Combined Operations, there are no officers holding commissions in all three Services.

R.A.F. Easter Leave

Mr. E. Smith asked the Secretary of State for Air whether he is aware that April 4th was the first holiday for months for the workpeople in the Manchester area, who were asked to remain at home, and that Blackpool is only 50 miles away; and why the football players serving in the Royal Air Force were not given leave for a few hours in order that they could have taken part in a football match, which would have had a beneficial effect on thousands of hard-worked workpeople and men serving in the Forces.

Captain Balfour : As the hon. Member will be aware, special steps were taken to reduce passenger travel on the railways to a minimum during the Easter period in order to make the lines more fully available for urgent goods traffic and travelling for pleasure, or business that was not vitally important, was discouraged. The Service Departments were invited to co-operate and rail travel for leave purposes was restricted. It would have been inconsistent and inequitable to have made an exception in favour of the players referred to.

Helicopters

Commander Locker-Lampson asked the Secretary of State for Air whether his attention has been drawn to the German revival of the helicopter; and whether, in view of the need for these machines, he will take steps for their early preparation?

Captain Balfour : I am aware of the German interest in this type of aircraft. Its possibilities are kept under review in this country, but priority in development and production is necessarily accorded to aircraft of wider operational possibilities.

Commander Locker-Lampson : Will the Minister bear in mind not to lose sight of the possibilities of development?

Captain Balfour : We shall not lose sight of any possibilities of development.

Mr. Henderson Stewart : Will the Minister keep in mind the possibilities of the very remarkable Scottish type of gyroplane which is now available?

Captain Balfour : We shall be glad to take advantage of the possibilities of development of any type of gyroplane, Scottish or English.

A.T.C. Grants

Mr. W. Joseph Stewart asked the Secretary of State for Air whether he is aware that in South Shields two squadrons of the Air Training Corps have found it necessary, owing to the smallness of the grants for the support of the units from Air Ministry funds, to appeal for financial support from the townspeople and the local authority; and will he see that sufficient funds are made available to make these units independent of grants from outside sources?

Sir A. Sinclair : The grants paid by the Air Ministry to units of the Air Training Corps together with issues in kind from Royal Air Force stocks are intended to cover the essential needs of the Corps and are in most cases ample for this purpose. In exceptional circumstances supplementary grants can be made. The grants normally paid are not intended to cover the provision of amenities, the cost of which is usually met from non-public funds, but where units experience difficulties in this connection they may apply for special grants out of a central welfare fund. The attention of the South Shields units has been drawn to the arrangements referred to above and the question of making additional funds available to them both for training and welfare is now being considered.

Plant Change-over

Mr. Lipson asked the Minister of Aircraft Production what steps he is taking to reduce the present long period of idle machines and idle workers in aircraft factories when there is a change-over to the construction of a new type of aircraft?

Colonel Llewellin : In mass production some disturbance is, of course, bound to be caused by a change-over from one type of machine to another. It has long been the endeavour of my Department to reduce such disturbance to a minimum, and I have given the matter my personal attention during the last few weeks. I hope to be able to make further improvements.

Mr. Lipson : While welcoming the fact that my right hon. and gallant Friend is giving personal attention to this important matter, may I ask whether he has an estimate of the time that has been lost owing to change-overs in production, and what percentage of that time he hopes to save?

Colonel Llewellin : I hope to save some of that time, but an over-all percentage would give a rather inaccurate figure. In some cases a particular type has faded out and another has been brought in without much loss, and in other cases there has been a considerable loss of time. My ambition is to reduce the loss of time to our best figure, if not below that.

Sir Joseph Lamb : Would it not be possible for workers to take their annual holiday during these periods?

Colonel Llewellin : In some cases it might be possible. In cases, such as the one which was dealt with in the House last week, annual holidays are given.

Captain Sir William Brass : Has my right hon. and gallant Friend been able to fill up the factories allocated to American machines before the United States came into the war?

Colonel Llewellin : That is a different question.

Women Police

Mr. Muff asked the Secretary of State for Air whether any differentiation is made in the pay or allowances of the women police in the Air Force according to whether the policewoman concerned is, or is not, a total abstainer?

Captain Balfour : No, Sir.

Funerals of Jap Airmen

Mr. Windsor asked the Secretary of State for Air whether any military honours have been granted at the funerals of Japanese airmen brought down at Colombo, in view of the attitude of Japanese airmen machine-gunning British women and children when leaving Singapore?

Captain Balfour : As His Majesty's Government is a signatory to the International Convention for the Amelioration of the Condition of the Wounded and Sick in Armies in the Field, there is no doubt that the Japanese airmen in question would be honourably interred.

Auxiliary Air Force Symbol

Wing-Commander Hulbert asked the Secretary of State for Air whether he will issue instructions that members of the Auxiliary Air Force receiving a commission subsequent to the outbreak of war may continue to wear the symbol "A" on their officers' uniforms?

Captain Balfour : I regret that I am unable to adopt my hon. and gallant Friend's suggestion. Airmen in the Auxiliary Air Force selected for commissions during the war are discharged from the Auxiliary Air Force and commissioned in the R.A.F.V.R. The wearing of the symbol "A" after commissioning would therefore be inappropriate.

Sunday Entertainments

Dr. Little asked the Secretary of State for War why, despite the protest of the citizens of Belfast made at six large meetings held in different parts of the city against the opening of theatres and music halls on Sundays for the entertainment of members of His Majesty's forces and the refusal of the Belfast City Council to give a licence for the holding of such variety shows, he gave his sanction to the holding of them; and, in particular, why the opening performance was held in the Hippodrome, which had been commandeered on the evening of the Sunday appointed as a national day of prayer for victory over all our enemies?

Sir J. Grigg : The refusal of the Belfast City Council related to the opening of places of entertainment for performances open to the public. The arrangements made by the General Officer Commanding the Troops in Northern Ireland afforded entertainment to members of the Services only. He exercised powers, conferred by Section 174A of the Army Act, which for many years have been exerciseable, under a delegated authority by local military commanders at their discretion. As to the last part of the question, I do not think that wholesome amusement is inconsistent with the worship of God or the defeat of our enemies.

HERE AND THERE

Correction

ON page 410 of *Flight* of April 23rd, there was a picture of a group of R.A.F. personnel at an air gunners' school of Training Command. The caption described them as "pupils," but it should have stated that they were air gunner instructors who were attending an air gunnery conference at the school.

They Also — Save!

PILOTS and ground personnel of a night fighter squadron in the North-East have organised their own National Savings group. In a month £45 was contributed.

Posters by an aircraftsman who was a commercial artist are displayed throughout the squadron offices. A typical poster shows Hitler seeing stars after a blow on the head from a money-bag.

"Henry Spurrier" Memorial

A FUND to endow a scholarship and to institute an annual memorial lecture in memory of the late Henry Spurrier, has recently been opened under the chairmanship of E. S. Shrapnell-Smith, C.B.E.

Henry Spurrier, who died last month in his 75th year, was for 40 years managing director of Leyland Motors, Ltd., which he founded, and since 1895 had spent his life in pioneering and establishing commercial road transport.

Cadet D.R.s for Civil Defence

MEMBERS of the Air Training Corps, Army Cadet Force and Junior Training Corps may volunteer for part-time messenger duty, as cyclists or motor cyclists, with Civil Defence Services and the National Fire Service.

When trained, they will be wanted only during or immediately after air raids, and their duties will involve risk and call for coolness and courage.

Each of the Civil Defence Services has its own Messenger Service and the scheme also applies to the Police Auxiliary Messenger Service, but in view of their Corps obligations, volunteer cadets will not have to perform the usual minimum number of hours' duty.

When on duty as a messenger, the cadet will wear his own Corps uniform with a special Civil Defence armlet.

The Trojan Horse

WE have just received a copy of the first issue of *The Martin Star*, a new house journal of the Martin aircraft factory at Baltimore, and in an editorial entitled "A Message from the Chief," Glenn L. Martin gives a warning to his workpeople of the need to be on their guard against the fifth-columnist.

"We have seen whole countries weakened for the kill by the Trojan Horse within—spies, saboteurs and propagandists," he says. "These must be the concern of every one of us, even while we bend our every effort towards production."

A most timely reminder to all! It's all part of the "Keep 'em Flying" service.

Air Gunner, Sgt. Kenneth O. Mackay, D.F.M. of No. 97 Squadron, who was among those decorated for the now famous daylight raid on Augsburg, is in civil life a member of the staff of one of *Flight's* associated journals. He described the new Lancaster bomber as "a wonderful aircraft." The citation appears on p. 462.

OPEN-AIR "WIND TUNNEL": This is an engine "test bench" used at the Boeing factory at Seattle. The dummy wing section is mounted on a circular rail track which enables it to face into wind, and the device is equipped to provide a close check on performance data.

A "Neutral" Point of View

HERE is what a young citizen of a small neutral State wrote to the Air Ministry recently. For obvious reasons his name and nationality are not given.

"For a long time I've been thinking to write a letter to you. Reading to-day an article 'Fly with the R.A.F.,' I made up my mind.

"Here it goes. Though I am a neutral by birth, I am English by heart. I am sure that if the gangsters win this war both my family and I shall be maltreated. And so I say: 'Have I got the right to be here seated with my arms across, while in Europe, in Asia, in Africa, millions of others are fighting for the welfare of Humanity, which is the same as for my own welfare?' No, I think that is to be too selfish. And that is why I write to you, sirs. To ask you to be so kind as to tell me if, not being British, I may join the R.A.F. or any other branch of His Majesty's Army or Navy.

"I must tell you that I am 20 years of age, physically fit, and above all—I HATE those Germans."

New B.S.I. Specifications

NEW specifications relating to splines and serrations and their gauges, to cover those types and sizes commonly used in aircraft production, have recently been issued by the British Standards Institution.

A committee of the S.B.A.C. investigated the matter in collaboration with the M.A.P. and B.S.I., and it was considered that the existing gauge tolerances were not appropriate for wartime production in that the variety of fits provided were unnecessary for aircraft purposes. The new standards provide for one class of fit only for serrations, namely, a sliding fit between the easy and close sliding fits of the 1929 standard, and two classes of fits for splines—easy sliding and close sliding fits.

Prepared by the S.B.A.C. committee, they are termed "British Standard Specifications for Spline Shafts and Holes for Aircraft (B.S. No. A.20) 1942, and Serrations and Serration Gauges (B.S. No. A.19) 1942."

Stars in Uniforms

A TALENT hunt at a Fighter Command group in the North-East has produced a number of promising candidates for the B.B.C.'s "Women at War" programme.

Among them is a 24-year-old W.A.A.F. corporal who has played principal boy in pantomime, toured with Gertie Gitana and G. H. Elliott, and played in repertory. Another artist is a sergeant with wide experience of operatic and dramatic society work who has broadcast in Australia. Then there are a L.A./CW. who holds five certifi-

HERE AND THERE

cates for pianoforte playing, and an A/CW. with professional experience of operatic singing, and a corporal who has appeared on the stage and in cabaret.

Missing Airliner

THERE is still no news, at the time of writing, of the Australian airliner—a Lockheed—which was reported missing last week on a flight from an airport in the east of the continent to Northern Australia.

This aircraft, commanded by Capt. D. H. Cameron, carried twelve Service passengers, had been missing for a week when the report reached us, and was believed to have got considerably off its course.

U.S. Naval Airships

AMERICA, who still uses airships for patrol work along the seaboard, has placed a contract for 21 long-range, non-rigid lighter-than-air craft for the Navy; these are in addition to those already on order.

Altogether, 48 airships have been authorised, and those under contract are 250ft. long, have a capacity of 416,000 cu. ft., and are powered by two Wright engines. Each has a crew of eight men.

U.S.A. View of the Typhoon

WRITING in *Flying and Popular Aviation* for April, 1942, Lt. Col. Harold E. Hartney (A.F. Res.) says of the Typhoon-Sabre combination: "Most readers appreciate that foreign pilots who have flown the Army P-47 Thunderbolt are keen about it. Some of them in their enthusiasm claim it is the best fighter in the world. The Thunderbolt must be good, for here are some of the data officially released on the best British fighter. It is the Hawker Typhoon created by Sydney Camm, who gave the R.A.F. its Hurricane, Fury and the Hart, each supreme in its day and class.

The end of a veteran. A D.H. Fox Moth after an attack by the Japs on Salamaua airfield in New Guinea. Over ten years old, this machine started its flying life on the "Doctor Service" of Northern Australia and was then operated on the New Guinea gold mine run.

The Typhoon is a compact, low-wing single-seater equipped with a Napier Sabre 24-cylinder H-type engine. The Sabre is one of the world's most efficient proven (in production) engines. Its efficiency is obtained by a high r.p.m. rate and high b.m.e.p., developing 2,350 h.p. for take-off and 1,800 h.p. at rated altitude.

"The plane travels more than 400 m.p.h. top, but its greatest asset is its high-altitude performance and speed of climb and dive. The R.A.F. officers take pride in pointing out that the Sabre develops more power than the engine which pulls the celebrated London-to-Edinburgh train Royal Scot (exhibited at the World's Fair, New York, two years ago). Its armament would make even a tank camouflage itself green—with envy. If our Thunderbolt is better it sure is some ship!"

"Elevenses" in a Sunderland over the Mediterranean.

Brazilian Whirlwinds

WRIGHT Whirlwind engines are to be manufactured in Brazil by the newly formed Fabrica Nacional de Motores, which is said to be the first aircraft engine company to be formed in that country.

This is the result of an agreement between the Wright Aeronautical Corporation and the Brazilian Government; the engines in question are the 7-cyl. and 9-cyl. types ranging from 235 h.p. to 450 h.p.

Waste of Light in Summer Hours

The following letter appeared in the "Daily Telegraph" of May 1st:

SIR,—May I express the hope that in the intensive drive for fuel economies the permanently blacked-out factories will not be overlooked? An immense potential remains to be tapped.

Electric light when used to duplicate daylight is merely wasted. It appals me to think that the long summer days, which were specially legislated for, are thus rendered useless in the national effort. Some factories have adjustable black-out blinds and shutters, but from many more the fuel-saving, health-giving sunlight is permanently excluded.

Something should be done. Working permanently without natural light is highly injurious physically and psychologically. Natural conditions of light and air are essential to the health of the worker and therefore for the maintenance of full efficiency and maximum production.

Yours faithfully,
GEOFFREY SMITH,
Man. Editor, *Aircraft Production*.
Dorset House, S.E.1.

Correspondence

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

HOME GUARD AIR ARM

Air Force Blue Battledress ?

I READ with interest the letter by "1926 A Licence" in your issue of April 16th, and am in favour of his suggestions regarding the proposed Home Guard Air Arm.

In my opinion, the idea should be carried a stage farther, so as to include men with experience of ground duties, particularly those with R.A.F. Service who have been discharged. It may even be possible for such men, in their spare time, to serve as ground staff on R.A.F. Stations and also to supplement existing personnel engaged on airdrome defence, transport, etc.

As to uniform, I would suggest an Air Force Blue battledress with distinguishing badge and usual indications of rank.

ALFRED K. HALL.

Many Pilots and G.E.s Eager to Help

I QUITE agree with your correspondent in *Flight* who suggests an Air Section of the Home Guard. I myself am in a reserved occupation on an airfield and I have been disgusted lately at the sight of idle Tiger Moths on the airfield and packed away in hangars, as well as other civil and ex-club aircraft.

I think it is high time we pre-war "A" licence pilots and ex-civil Air Guard "sweats," who, it seems, will be forced to join the Home Guard very soon, got together on the idea of an Air Section of the Home Guard.

As your correspondent mentions, there are many ground engineers and "A" licence pilots like myself who are now employed in aircraft manufacture and repair who would be only too glad to do their extra "bit" in their spare time in maintaining and flying the light aircraft they know so well.

Also, I am sure, we should have no grudge against similar discipline to that of the Home Guard, and I sincerely hope this scheme will be adopted by the proper authorities and action taken in the very near future.

"EX-CLUB PILOT AND G.E."

Particular Scope for M.U. Men

I WOULD like to make further suggestions on the subject of forming a Home Guard Air Arm. I am a member of the Home Guard and I am employed as a fitter on a maintenance unit of the R.A.F. There are a number of civilian M.U.s in different parts of the country and most of them have their own H.G. units. We could be trained as airborne units so that we could be rushed by air to places where we may be needed most if this country were invaded.

As for the types of aircraft to be used, we could use the planes that are waiting for issue on the station, and as each M.U. has its own test pilots they could fly the planes and return to the station with them after dropping the H.G. personnel at the desired place.

As for maintenance of aircraft that have been idle since the beginning of the war, they could be turned over to H.G. units employed on M.U.s and could be kept in flying condition by the H.G.s in their spare time.

As most of us employed on M.U.s are used to flying, the training would not be difficult.

"AN AIR-MINDED H.G."

VAPOUR TRAILS

Faded Like "Wake" of Boat

AS a reader of your paper for some years I was very struck by a phenomenon observed recently which I do not remember reading about in any newspaper or other publication, though many have been the articles on vapour trails.

The sky was cloudless, rather glaring, slight horizon haze, wind east, barometer 30in. approximately, calm and warm for the time of year.

At 13.40 hours, attracted by the hum of an aircraft going north-south, I looked up and observed directly overhead a vapour trail resembling the wake of a fast boat in a dead calm deep blue sea. The trail, unlike all others I have seen by day or by night or pictorially, did not lengthen as the aircraft moved across the sky, nor did it broaden and change shape in the wind; it just behaved exactly as the stern wash of any boat, fading out gradually and keeping an even length from the tail of the aircraft to the end of the trail, just as though it was a streamer or drogue being towed.

Through binoculars, the aircraft was still invisible, but the vapour trail then showed as four close together, with the two centre ones fading out before the outer ones. At a very rough guess I should say the trail was some 400 yards long.

As the aircraft was invisible it is impossible to say with any degree of accuracy the type or size, but from the sound it was probably a twin-engine type, with a Merlin murmur rather than a radial roar. In this case the vapour trails may have started from the tips of the main wings and the tailplane, otherwise it would seem as though the machine must have been a four-engined type, with a trail left behind from the slipstream from each airscrew.

I should be very interested to receive any explanations you or any of your readers can give, and to hear whether this is a common sight to others under a busier sky than myself.

R. N. DIXON.

ARMY SQUARE PEGS

Duly Enlisted, but Still a "Civvy"

I CAN understand very well the feelings of your correspondents who have been disappointed over the cancellations of their transfers from the Army to the R.A.F. I am still in civil life, but I think my case is similar to theirs in some respects.

Early in June, 1941, I was provisionally accepted as a Flight Mechanic, and in September I was duly enlisted in that capacity and placed on deferred service. On enlistment I was told that I would probably be recalled in three to six weeks, but twenty-nine weeks have now passed and I am still waiting.

I have made various enquiries, and the authorities have now suggested that if I am not satisfied with the present position perhaps I would prefer to join one of the other Services.

It seems extraordinary that such a state of affairs is allowed to exist at a time when we are supposed to be fighting for our very existence, and it would be interesting to know the opinions of others who are awaiting recall.

"1516246."

AIR POLICY

Fighters More Vital Than Bombers

MAY I again take up some of your valuable space in criticising our bombing policy? Since I wrote my last letter we have suffered some more defeats, mostly because of our lack of air support for our troops and ships.

For instance, on March 31st, in Burma, we were unable to send out reconnaissance 'planes because we had no fighter protection to give them; this also applies to the two cruisers *Dorsetshire* and *Cornwall*, which have been sunk recently. These ships must have been within striking distance of long-range fighters, as our T.S.R. aircraft went out to attack the enemy ships.

In the week March 22nd to 28th we lost forty-three bombers; this means about 250 trained personnel were also lost. With these bombers we lost approximately 122 aero engines, taking one-third as four-engined bombers and the other two-thirds as twin-engined. If instead we had used these motors for fighters, 112 single-motor fighters could have been built. There is no doubt that the bombers do great damage to German industries, but against this is the high loss of bombers, which cost from £20,000 to £50,000 each and take many more man-hours to build than fighters or light attack aircraft.

I should think if the twelve-gun "Hurricane" were fitted with a radial motor of 1,600 h.p. the speed could be kept in the neighbourhood of 400 m.p.h. If we built nothing else but fighters for the next two years, then, after we had cleared the air of enemy fighter opposition, we could again start building bombers which would have such unlimited fighter support that there would be no opposition from the enemy's air defences.

Every day I read in the papers and in aviation journals of our lack of fighter support for troops and ships, and, as far as I can see, there seems to be very little done about it.

R. J. BROOKES.

Service Aviation

Royal Air Force and Fleet Air Arm News and Announcements

Flight mechanics of the W.A.A.F. get air experience. A formation of Miles Master IIIs carrying their feminine passengers.

V.C. Awarded

Decorations for the Augsburg Raid

THE KING has been graciously pleased to confer the VICTORIA CROSS on the undermentioned officer in recognition of most conspicuous bravery:

Act. Sqn. Ldr. J. D. NETTLETON, No. 44 (Rhodesia) Sqn.

Sqn. Ldr. Nettleton was the leader of one of two formations of six Lancaster heavy bombers detailed to deliver a low-level attack in daylight on the diesel engine factory at Augsburg, in Southern Germany, on April 17th, 1942. The enterprise was daring, the target of high military importance. To reach it and get back some 1,000 miles had to be flown over hostile territory.

Soon after crossing into enemy territory his formation was engaged by 25 to 30 fighters. A running fight ensued. His rear guns went out of action. One by one the aircraft of his formation were shot down, until in the end only his own and one other remained. The fighters were shaken off, but the target was still far distant. There was formidable resistance to be faced.

With great spirit, and almost defenceless, he held his two remaining aircraft on their perilous course, and after a long and arduous flight, mostly at only 50 feet above the ground, he brought them to Augsburg. Here anti-aircraft fire of great intensity and accuracy was encountered. The two aircraft came low over the roof tops. Though fired at from point blank range, they stayed the course to drop their bombs true on the target. The second aircraft, hit by flak, burst into flames and crash-landed. The leading aircraft, though riddled with holes, flew safely back to base, the only one of the six to return.

Sqn. Ldr. Nettleton, who has successfully undertaken many other hazardous operations, displayed unflinching determination as well as leadership and valour of the highest order.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in the same operations:—

The following officers and airmen who participated, in various capacities, as members of the aircraft crews, displayed courage, fortitude and skill of the highest order:—

COMPANION OF THE DISTINGUISHED SERVICE ORDER.

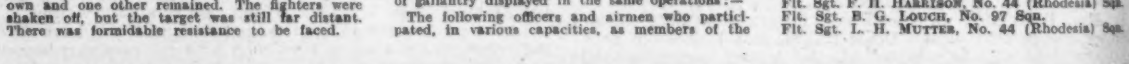
Flt. Lt. D. J. PENMAN, D.F.C., No. 97 Sqn.

DISTINGUISHED FLYING CROSS.

Flt. Lt. B. R. W. HALLOWS, R.A.F.V.R., No. 97 Sqn.
Act. Flt. Lt. C. S. C. MCCLURE, R.A.F.V.R., No. 44 (Rhodesia) Sqn.
Act. F/O. E. E. RODLEY, R.A.F.V.R., No. 97 Sqn.
F/O. E. A. DEVERILL, D.F.M., No. 97 Sqn.
P/O. P. A. DOREHILL, R.A.F.V.R., No. 44 (Rhodesia) Sqn.
P/O. G. C. HOOEY, R.A.F.V.R., No. 97 Sqn.
P/O. E. L. IPOULD, R.A.A.F., No. 97 Sqn.
P/O. D. O. SANDS, R.A.F.V.R., No. 44 (Rhodesia) Sqn.

DISTINGUISHED FLYING MEDAL.

Flt. Sgt. F. H. HARRISON, No. 44 (Rhodesia) Sqn.
Flt. Sgt. B. G. LOUCH, No. 97 Sqn.
Flt. Sgt. L. H. MUTTER, No. 44 (Rhodesia) Sqn.



Decorated for their share in the daylight raid on Augsburg:

(Left to Right) *Front Row:* P/O. COLQUHOUN; P/O. CUTTING; P/O. FRIEND; Flt./Lt. HALLOWS; F/O. RODLEY; Flt./Lt. PENMAN, D.F.C.; P/O. DEVERILL, D.F.M.; P/O. BUTLER; P/O. HOOEY.

Centre: Sgt. HENLEY; Sgt. CUMMINGS; Sgt. JONES; Sgt. BROOMFIELD; Sgt. DEVINE; Sgt. MACKAY; Sgt. COOPER; Flt./Sgt. KEANE; Flt./Sgt. LOUCH; Sgt. TALES.

Back Row: Sgt. GOACHER; Sgt. MERRALLS; Sgt. CRISP; Sgt. RATCLIFFE; Sgt. OVERTON; Flt./Sgt. ELLWOOD; Sgt. IRONS; Sgt. HEBDON.

SERVICE

Sgt. C. F. CHURCHILL, No. 44 (Rhodesia) Sqn.
Sgt. T. H. GOACHER, No. 97 Sqn.
Sgt. D. N. HUNTLY, No. 44 (Rhodesia) Sqn.
Sgt. R. P. IRONS, No. 97 Sqn.
Sgt. K. G. MACKAY, No. 97 Sqn.
Sgt. D. L. OVERTON, No. 97 Sqn.
Sgt. J. T. RATCLIFFE, R.C.A.F., No. 97 Sqn.

Awards

FLEET AIR ARM

THE KING has been graciously pleased to approve the following awards for sustained courage, skill and enterprise in many air operations by night and day, against the enemy in the Mediterranean.

THE DISTINGUISHED SERVICE CROSS.

Lt. (A) H. M. ELLIS, D.F.C., R.N.
Act. Lt. M. M. DUNLOP, R.N.
Act. Lt. J. D. JACKSON, R.N.
Lt. V. N. S. DAVIES, R.N.R.
Sub-Lt. (A) O. W. TATTERSALL, R.N.
Act. Sub-Lt. (A) R. F. BRADSHAW, R.N.
Act. Sub-Lt. (A) A. D. MAHER, R.N.
Act. Sub-Lt. (A) J. M. BROWN, R.N.V.R.
Temp. Sub-Lt. (A) P. S. WELLINGTON, R.N.V.R.
Temp. Act. Sub-Lt. (A) R. F. SUTTON, R.N.V.R.

THE DISTINGUISHED SERVICE MEDAL.

Ldg. Airman E. BODDY.
Ldg. Air Fitter (O) J. CONNOLLY.

MENTION IN DESPATCHES.

Act. Sub-Lt. (A) R. JOLLY, R.N.
Act. Sub-Lt. (A) J. W. POWELL, R.N.
Ldg. Airman A. T. COLLINGS.
Temp. Ldg. Airman E. KENNELLY.
Ldg. Air Fitter D. W. F. PRICE.

FOR gallantry and coolness in many air operations against the enemy:—

MENTION IN DESPATCHES.

Ldg. Airman L. P. E. PORTER (Posthumous).

For resource and cheerfulness when his aircraft was lost:—Ldg. Airman E. A. GOWAN.

ROYAL AIR FORCE

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

DISTINGUISHED SERVICE ORDER.

Act. Wing Cdr. R. F. BOYD, D.F.C. and Bar, A.A.F.—Since December, 1941, this officer has led a wing on many operational missions. Many of the outstanding successes which have been obtained can be attributed to the leadership, skill and fighting spirit of this officer. Since being awarded a Bar to the D.F.C., Wing Cdr. Boyd has destroyed a further 12 enemy aircraft, bringing his total victories to 22.

Sqn. Ldr. T. H. BOYLAN, D.F.C., No. 106 Sqn.—In a second tour of operational flying since being awarded the D.F.C., Sqn. Ldr. Boylan has carried out a further 27 sorties over enemy territory and waters. In the course of these operations, a wide variety of targets have been attacked, including targets in Hamburg, Gelsenkirchen, Kiel, Cologne and other important centres. He has also participated in three attacks on the enemy warships when berthed at Brest. All his missions have been carried out with commendable thoroughness and skill. Over a period of six months, this officer has commanded a flight with conspicuous success, and the performance of his ground duties has been beyond reproach. He has set an inspiring example.

BAR TO DISTINGUISHED FLYING CROSS.

Act. Sqn. Ldr. F. J. LUCAS, D.F.C., R.N.Z.A.F., No. 75 (N.Z.) Sqn.—Since being awarded the D.F.C., this officer has completed a further 20 sorties. Throughout Sqn. Ldr. Lucas was in command of his flight, and, by his outstanding keenness for operations he did much to encourage and promote a fine fighting spirit. His courage and perseverance over heavily defended targets in order to secure photographs of his objectives have been most marked. His enthusiasm is such that he was genuinely disappointed when taken off operations.

Act. Sqn. Ldr. A. M. PAAPE, D.F.C., No. 61 Sqn.—This officer has completed 26 sorties, since being awarded the D.F.C. He has always shown the greatest determination to press home his attacks, often at low altitude and in the face of intense opposition. He participated in a recent attack on the German battleships at sea in convoy. Observation was extremely difficult owing to the bad weather, and Sqn. Ldr. Paape discovered that he was flying over the ships at about 800 feet.

He flew on as his rear gunner opened fire and, although his aircraft was hit by shell-fire on two occasions, Sqn. Ldr. Paape returned to the attack and released his bombs from 450 feet to score hits on an escorting destroyer. Skilfully escaping from the fire zone, although his aircraft was again hit by shell-fire, Sqn. Ldr. Paape flew his aircraft safely to base with the bomb doors open, all turrets out of action, petrol leaking from his starboard tank and the hydraulics, brakes and trimming gear damaged and useless.

Grp. Capt. A. M. WRAY, M.C., D.F.C., A.F.C.—One night in March, 1942, this officer participated in an attack on the Ruhr. To ensure success, Grp. Capt. Wray deliberately descended to a low altitude, in the face of fierce opposing fire, to bomb his objective. His gallantry and exceptional leadership have set a most inspiring example.

Act. Flt. Lt. D. W. A. STONES, D.F.C.—Since being awarded the D.F.C., this officer has destroyed at least six enemy aircraft besides damaging many more. By his exceptional ability and complete disregard of danger, Flt. Lt. Stones has set an example worthy of the highest praise.

F/O. M. A. SMITH, D.F.C.; R.A.F.V.R., No. 83 Sqn.—On February 12th, 1942, this officer was the captain of an aircraft which participated in an attack on German battleships at sea. When nearing the objectives, his aircraft was attacked by three enemy fighters. The rear gunner was wounded in the hand and chest, but he opened fire on one of the attackers, causing it to dive away. It was then shot down by the front gunner.

Although another of the fighters was shot down, F/O. Smith's aircraft had sustained much damage. The starboard wing was pierced by a cannon shell, the starboard rudder shot away in shreds and other damage was sustained. Nevertheless, by a fine display of airmanship, F/O. Smith succeeded in flying the aircraft safely back to this country, where he made a safe landing. In the face of difficult circumstances, this officer displayed great skill and courage.

F/O. R. MCFARLANE, D.F.C., R.A.F.V.R., No. 83 Sqn.—On February 12th, 1942, this officer was the captain of an aircraft which participated in an attack on the German warships at sea. When approaching the battleships at an altitude of 500 feet, his aircraft was attacked by two enemy fighters whose pilots made three separate attacks. The hydraulic system was rendered unserviceable and the bomb doors could not be opened.

The crest of the Yugo-Slavian squadron operating with the Middle East Command. The motto reads "For King and Country."

AVIATION

Unaware of the damage sustained, P/O. McFarlane skilfully evaded his attackers and made his run over the battleships. His aircraft was thereupon subjected to a fierce barrage and sustained further damage. The port and starboard rudders were pierced in innumerable places and large gaps were torn in the fuselage by shell-fire. Meanwhile, the elevator cables had been damaged and were only holding by two strands of wire. Nevertheless, P/O. McFarlane flew the aircraft back to this country and finally made a safe landing. Throughout, this officer showed great skill, courage and determination.

DISTINGUISHED FLYING CROSS.

P/O. G. W. RUTLIDGE, No. 30 Sqn.

P/O. C. D. WADDINGHAM, R.A.F.V.R., No. 9 Sqn.

Act. Wing Cdr. D. O. FINLAY.—From September, 1940, to August, 1941, Wing Cdr. Finlay was the commanding officer of No. 41 Sqn. He participated in many sorties, during which he destroyed at least three enemy aircraft in combat. On one sortie, he attacked a German ship, leaving it a mass of flames. During the period, his squadron destroyed 66 enemy aircraft. Since joining his present unit Wing Cdr. Finlay has participated in several sorties. On March 3rd, 1942, he destroyed a Messerschmitt 109 following a courageous head-on attack, thus bringing his victories to four. This officer has always shown great keenness and he has set a splendid example to all.

Act. Sqn. Ldr. J. C. CARVER, R.A.F.V.R., No. 118 Sqn.—This officer has carried out numerous operational flights of a varied character, including an attack on the German battleships at sea on February 12th, 1942. On March 13th, 1942, during a patrol, his aircraft sustained damage from the fire of a Junkers 88 and Sqn. Ldr. Carver was forced to leave the aircraft by parachute.

Whilst so doing, he struck his face against the hood and was stunned; thus, when entering the water following his descent, he was still harnessed to his parachute. With some difficulty he disentangled himself from the shrouds and then succeeded in inflating his dinghy and clambering safely aboard. Unperturbed by the hazards which confronted him, Sqn. Ldr. Carver decided to paddle his way to the English coast, a distance of some 70 miles. Excepting for unforeseen circumstances, he estimated that the task could be accomplished within three days.

Although his two compasses had been rendered unserviceable through immersion, Sqn. Ldr. Carver checked his course and position in daylight by the sun and at night by the stars. In this way he maintained his correct course and estimated rate of travel. During the journey he adopted a strict rationing of his supplies and quenched his thirst by drinking, at regular intervals, small quantities of rain water which collected in the apron of his dinghy.

At about 01.30 hours on March 16th, Sqn. Ldr. Carver had reached a point seven miles from the English coast, where, after being afloat for 57 hours in wintry conditions, he was rescued by one of H.M. ships whose attention he had attracted by blowing his whistle. Throughout, this officer's conduct and actions, in a situation which demanded a high degree of fortitude, courage and

Loading .5in. ammunition into the Starboard wing containers of a Curtiss Kittyhawk fighter operating in the Middle East.

SERVICE

determination, were worthy of the highest tradition of the Service.

Flt. Lt. R. J. S. WOOTTON, No. 69 Sqn.—Flt. Lt. Wootton has completed a large number of operational flights in the Middle East. His reconnaissance work has been executed with exceptional skill and gallantry and has produced most valuable results. Throughout a long period, he has shown great devotion to duty.

Act. Flt. Lt. A. R. H. BARTON, R.A.F.V.R., No. 124 Sqn.—This officer has proved himself to be a keen and courageous pilot. He fought with great distinction in the Battle of Britain and destroyed five enemy aircraft before he himself was shot down and severely wounded. Flt. Lt. Barton resumed operational flying in February, 1941, since when he has participated in many sorties against the enemy. Throughout, he has set a magnificent example.

Act. Flt. Lt. E. P. W. BOCOCK, R.A.F.V.R., No. 602 Sqn.—Since July, 1941, this officer has participated in many operational sorties. Throughout, he has displayed courage, initiative and great energy. He has destroyed at least three enemy aircraft, two of which he shot down on one sortie.

Act. Flt. Lt. C. N. WAWN, R.A.A.F., No. 452 (R.A.A.F.) Sqn.—This officer has completed a large number of operational sorties. He has proved himself to be a sterling pilot and a good leader. He has destroyed at least two hostile aircraft.

Wing Cdr. J. M. LEREW, R.A.A.F.

Flt. Lt. D. W. I. CAMPBELL, R.A.A.F.

These officers have displayed outstanding courage, determination, skill and tenacity in the course of bombing raids on enemy positions in New Britain.

Flt. Lt. W. A. PEDRINA, R.A.A.F.—In February, 1942, this officer took part in a low-level attack on enemy destroyers and transports, in the face of intense fire, at Gasmata, New Britain. Later in February he carried out a single daylight reconnaissance of enemy shipping at Rabaul. In spite of being attacked by enemy fighters and ground defences and having his gunner killed and aircraft damaged, he completed his reconnaissance and returned over 500 miles to his base with extremely valuable information.

Wing Cdr. T. B. COOPER, No. 502 Sqn.—While in command of the squadron, this officer displayed great powers of leadership and raised the squadron to a high state of efficiency. He insisted on taking his place on the roster of captains of aircraft and, as such, he carried out 38 operational sorties, of which the average duration was of more than nine hours. He invariably took the more difficult and hazardous tasks to himself. In carrying out his flights against the enemy, far out over the Atlantic and in extremely bad weather, both by day and by night, Wing Cdr. Cooper set a magnificent example of fortitude and skill.

Act. Sqn. Ldr. L. C. DEANE, No. 144 Sqn.—This officer has completed his operational sorties with a high degree of success. He has participated in attacks on many of the enemy's dockyard towns and industrial centres. As flight commander he has shown marked enthusiasm and, although his duties both in the air and on the ground have been long and arduous, he has performed them with great willingness. He has undoubtedly contributed materially to the successes achieved.

Act. Flt. Lt. F. A. DRURY, R.A.F.V.R., No. 77 Sqn.—This officer has performed consistently good work as pilot with excellent results. Despite adverse weather, searchlight activity and heavy anti-aircraft fire, he has taken infinite trouble to complete his tasks. He has always shown a fine fighting spirit and he has pressed home his attacks with great determination. Amongst the many places he has attacked are Brest, Cuxhaven, Hamburg, La Pallice, Stavanger and Wilhelmshaven.

Part of the training of Wren photographers includes six hours' flying to get air experience. The girl has just landed from a flight in a Blackburn Shark II.

P/O. N. CLAYES, No. 9 Sqn.—As a wireless operator-air gunner, this officer has been engaged on operational flying since January, 1940. He has participated in many sorties over enemy and enemy-occupied territory, including attacks on Bremen, Den Helder, Brest, and other highly defended areas. On one occasion in March, 1940, during a reconnaissance flight over N.W. Germany, his wireless equipment became unserviceable on the return journey.

By means of an Aldis lamp, P/O. Clayes succeeded in obtaining a position fix from one of H.M. ships, thus greatly assisting in the safe return of his aircraft. P/O. Clayes participated in operations in France in support of the B.E.F. when enemy troop concentrations, dumps, batteries and searchlights were successfully attacked and a supply train crossing a viaduct near Namur was blown up. As squadron signals officer, he has displayed a high degree of efficiency and zeal.

P/O. J. H. DAY, R.A.F.V.R., No. 50 Sqn.—P/O. Day, a South African, joined the squadron in September, 1941. He proved himself to be a fine navigator, and, with one exception, he has always successfully attacked his original target. The exception was owing to extremely bad weather, but, even so, an alternative target was found and bombed. He has participated in attacks on Kiel, which he bombed from 1,800 feet, Hamburg and Essen (at the latter place a hit was scored on Krupp's works), and finally on December 27th, 1941, he participated in the combined operations on Vaagso.

His task was to bomb the coastal defence guns on Rugsundo Island. By careful navigation he arrived according to schedule and skilfully guided his pilot to the target. During the bombing run his aircraft was subjected to fierce anti-aircraft fire, and one shell burst inside his compartment. Although seriously wounded, P/O. Day held the pilot on the course and released his bombs right on the enemy's guns from 150 feet. He then told his captain the course to follow for base before he lost consciousness.

When the aircraft was subsequently safely landed at base, it was found that P/O. Day had sustained multiple shrapnel wounds to his face and chest, and that his left leg had received an injury which necessitated an amputation. Throughout, his bravery and devotion to duty were outstanding. P/O. Day is now recovering in hospital and confidently expects to resume operational flying.

P/O. N. E. GOLDSMITH, R.A.F.V.R., No. 50 Sqn.—As captain of aircraft, this officer has been engaged on operational flying since September, 1941. He has at all times shown the greatest tenacity in completing his allotted task. He has participated in many sorties, including a low-level attack on Kiel, which was bombed from 1,800 feet. P/O. Goldsmith took part in the combined operations on Vaagso, and, on this occasion, he attacked his target from only 150 feet. During the engagement his navigator was seriously wounded.

On the return journey, P/O. Goldsmith flew to the nearest airfield in the Shetlands, made a safe landing, and immediately procured medical assistance for his wounded comrade. His prompt action probably saved the navigator's life.

On February 12th, 1942, this officer participated in an attack on the German warships on their voyage through the Channel. Following a methodical search, he flew across the convoy and was met by fierce anti-aircraft fire. Undeterred, he pressed home his attack and released his bombs across one of the battleships from 800 feet. After regaining height, his aircraft was hit by shell-fire and it became uncontrollable. P/O. Goldsmith skilfully regained control, however, and was then able to fly the aircraft safely back to this country. Throughout he showed great courage and superb airmanship.

P/O. J. W. HANNANT, R.A.F.V.R., No. 51 Sqn.—This officer joined the squadron as an N.C.O. in September, 1940, and for nearly a year was almost continually employed on operational flying. He quickly showed himself to be a first-class wireless operator. He has performed valuable work in training new crews and, although since June his energies have been mainly concentrated on this, his keenness has secured him a place on a crew for two further operations. During his operational missions he has participated in attacks on many important enemy targets, including Berlin, Turin, Wilhelmshaven, Kiel and Brest.

Flt. Lt. R. D. YULE, No. 501 Sqn.—Flt. Lt. Yule took part in operations in France in May, 1940.

AVIATION

Back in its own roost. A Hurricane which was captured and used by the Germans now recaptured intact on Gambut aerodrome.

SERVICE AVIATION

and subsequently fought in the Battle of Britain. He is a keen and courageous fighter pilot, and he has destroyed at least five hostile aircraft and damaged four others.

Flt. Lt. A. G. L. HUMPHREYS, No. 218 Sqn.—As captain of aircraft and wireless operator respectively, Flt. Lt. Humphreys and Sgt. Wheeler participated in an attack on Lubeck on the night of March 28th, 1942. On the return journey, whilst over the Kiel Canal, the aircraft was subjected to a series of attacks by an enemy fighter. The rear gunner was wounded, the mid-upper and rear turrets were put out of action, and other damage was sustained by the aircraft.

During the action Flt. Lt. Humphreys' aircraft was forced down to some 200 feet, but, largely due to the excellent collaboration between himself and Sgt. Wheeler, he finally succeeded in evading his attacker and flew his damaged aircraft back to base, where he made a safe landing.

Throughout the combat, this officer displayed high skill and courage and was greatly assisted by Sgt. Wheeler, who steadfastly remained at his post, giving clear directions of the enemy's tactics. Both Flt. Lt. Humphreys and Sgt. Wheeler have carried out many sorties over enemy territory.

DISTINGUISHED FLYING MEDAL.

Sgt. K. WHEELER, No. 218 Sqn.—For citation see Flt. Lt. Humphreys above.

Flt. Sgt. T. W. WILLMOTT, No. 260 Sqn.—In March, 1942, this airman flew with his squadron as escort to a force of bombers engaged on a bombing mission. During the flight our aircraft were intercepted by enemy fighters and, in the ensuing engagement, Flt. Sgt. Willmott destroyed one and damaged another of the hostile aircraft. When returning to base he observed one of our fighters being attacked by three Messerschmitt 109s. Having expended his ammunition, he carried out feint attacks on the enemy fighters which eventually broke away. Flt. Sgt. Willmott has carried out many sorties of a determined character, and he has always displayed great keenness to inflict damage on the enemy.

Sgt. J. H. ARNOLD, No. 7 Sqn.—On the night of March 28th, 1942, this airman was the rear gunner of an aircraft which took part in an attack on Lubeck. During the return journey, whilst over the Heligoland Bight, the aircraft was intercepted by an enemy fighter. Sgt. Arnold gave skilful evading directions which enabled his captain to out-manœuvre the enemy pilot. Sgt. Arnold was thus able to deliver an accurate burst of fire, causing the enemy aircraft to break away and dive towards the sea, with both engines on fire. By his courage and fine shooting, this airman contributed materially to the safe return of his aircraft.

Flt. Sgt. J. S. BANKS, R.C.A.F., No. 9 Sqn.—One night in January, 1942, this airman was the front gunner of an aircraft which carried out a low level attack on the airfield at Schipol. Nearing the airfield a Dornier 217 was intercepted and Flt. Sgt. Banks coolly shot it down from close range. During the bombing run his aircraft was held in the searchlights, but, by his accurate fire, Flt. Sgt. Banks extinguished two of them and, at the same time, warned his pilot, who was blinded by the glare, of the danger of colliding with a hangar.

This airman has participated in 31 sorties over enemy and enemy-occupied territory wherein targets have been attacked at important centres such as Dusseldorf, Hamm, Cologne, Kiel, Genoa and Brest.

Flt. Sgt. T. W. BELL, No. 49 Sqn.—As wireless operator-air gunner this airman has participated in a large number of sorties, including attacks on Berlin, Frankfurt, Mannheim, Hamburg, Bremen and Brest. The technical excellence of his work as wireless operator is equalled only by his genuine enthusiasm for operational flying. On two occasions, when his aircraft has been attacked by enemy fighters, Flt. Sgt. Bell has proved of the greatest assistance to his pilot.

On February 12th, 1942, he participated in an attack on the German warships at sea. In driving rain, he was the first member of the crew to observe the enemy and his clear instructions enabled his pilot to make an attack. He has invariably set a most valuable example.

Flt. Sgt. R. T. BRISCOE, No. 138 Sqn.—From the beginning of the war until April, 1941, this airman was continuously engaged on operational flying. In June, 1940, he participated in the first raid on Italy when the Fiat works were attacked. As wireless operator-air gunner he has shown great skill and coolness.

Flt. Sgt. G. L. DONNELLY, No. 76 Sqn.—This airman has been employed as wireless operator-air gunner since the beginning of the war and has participated in attacks on targets in Germany, Italy, Norway, France and Belgium.

Flt. Sgt. (now P/O.) E. F. G. HEALEY, No. 106 Sqn.—Flt. Sgt. Healey carried out his first eleven operational flights as navigator and attained a very high standard of accuracy which enabled his pilot to attack his original targets successfully. As captain of aircraft he has carried out a further 18 sorties. The success of his first raid, when he bombed Cologne from 4,000 feet, continued throughout the remainder of his sorties and culminated in a highly successful attack on the Huls chemical factory.

Flt. Sgt. A. M. M. HILL, A.A.F., No. 35 Sqn.—As wireless operator-air gunner, this airman has participated in numerous sorties, involving a large number of flying hours over a long period. His operational missions have included no less than ten raids on Berlin as well as many other keenly defended areas. His captains have always placed implicit faith in his skill as a wireless operator, and the fact that his aircraft has never been involved in a navigational error reflects greatly to his credit.

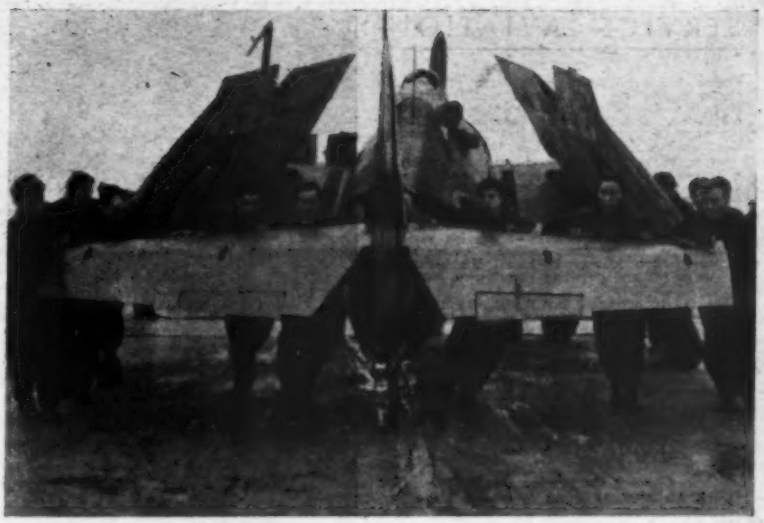
Flt. Sgt. R. K. KITNEY, No. 103 Sqn.—This airman has at all times shown a high degree of skill, courage and initiative. At the beginning of his operational tour he was badly shaken by having to spend 13 hours in a dinghy after having been forced to alight on the sea, but, by his quiet and dogged determination, he has proved himself to be an outstanding captain. Flt. Sgt. Kitney has participated in attacks on many important targets in enemy and enemy-occupied territory, and he has, on several occasions, succeeded in attacking his original target where others have failed.

On February 12th, 1942, notwithstanding the fact that he had taken part in an operational flight the night before, this airman volunteered at short notice to take part in operations against the German warships at sea. He located the German naval force in the North Sea area and, despite appalling weather, shadowed them and sent repeatedly reports of their position to base. This airman has consistently displayed fortitude and bravery in action.

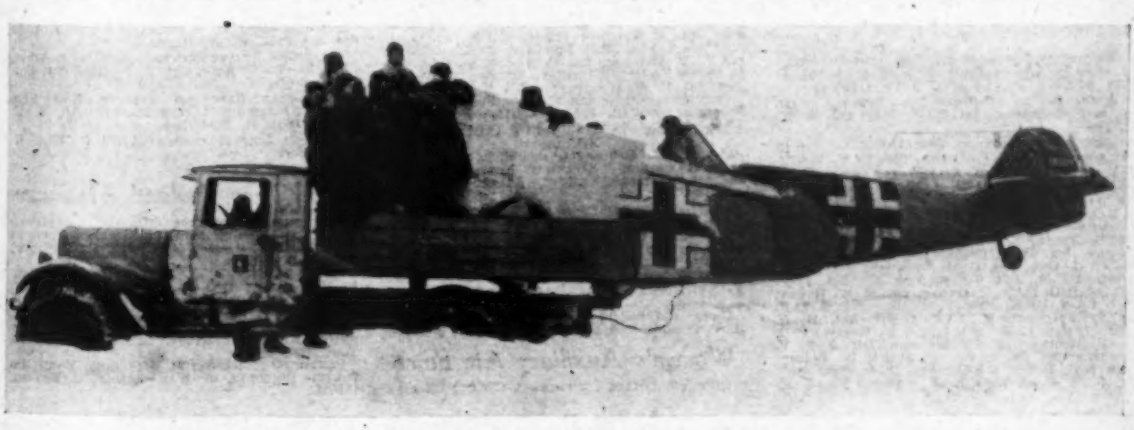
Flt. Sgt. O. P. J. RICHARDS, R.A.F.V.R., No. 9 Sqn.—As wireless operator-air gunner, this airman has participated in numerous sorties over enemy and enemy-occupied territory, including attacks on Berlin, Hamburg, Kiel, Bremen, Wilhelmshaven and Brest. In one sortie on Berlin, Flt. Sgt. Richards was wounded over the right eye by shrapnel while the aircraft was held in the searchlights over the target. Nevertheless, he continued to discharge his duties courageously and efficiently.

Flt. Sgt. P. WOODHEAD, No. 144 Sqn.—This airman, as pilot, has participated in attacks on Cologne, Karlsruhe, Frankfurt, Bremen, Berlin, Rotterdam and Brest. Many of these sorties were carried out in bad weather, but Flt. Sgt. Woodhead has always taken great pains to locate the target.

Sgt. J. BELL, No. 9 Sqn.—As an air gunner this



Most of the modern American carrier-borne aircraft fold their wings upwards. The Grumman Martlet—here shown on the deck of H.M.S. "Illustrious"—folds in the old style.



A Russian salvage party taking a captured Me 109 back for repair and reuse against the original owners. It appears to be almost intact.

SERVICE AVIATION

airman has participated in a large number of sorties over enemy and enemy-occupied territory. Many important targets have been attacked, including Calais, Kiel, Dusseldorf, Cologne and Brest. One night in August, 1941, he was the rear gunner of an aircraft which attacked Mannheim.

Owing to severe icing conditions, the aircraft went out of control at 14,000 feet and fell to 2,000 feet before the pilot regained control. During its descent, the aircraft turned over several times but, despite this, Sgt. Bell maintained communication with his captain. When the aircraft was again flying normally Sgt. Bell, by his various observations, was of great assistance to his pilot on the return journey to base. His keenness, determination and unfailing cheerfulness have set an inspiring example.

Sgt. H. CHESTERMAN, R.A.F.V.R., No. 110 Sqn.—This airman has participated in operational flying over a long period in sorties both by day and by night wherein a wide variety of targets have been attacked, including airfields, dockyard installations and industrial centres. He is an extremely able wireless operator, and his efficiency has contributed materially to the success of many of the operations in which he has participated.

Roll of Honour

Casualty Communique No. 128.

THE Air Ministry regret to announce the following casualties on various dates. The next-of-kin have been informed. Casualties reported "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Royal Air Force

KILLED IN ACTION.—Sgt. R. C. Bell; Act. Sqn. Ldr. L. W. Coleman, D.F.C.; P/O. C. F. Ferris; Sgt. N. T. Gander; Sgt. D. A. Graham; Sgt. J. Millichip; Act. Flt. Lt. C. L. Pilkington; P/O. P. H. T. Rogers; Sgt. R. A. Shea; Sgt. H. Skelton.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESDMED KILLED IN ACTION.—Sgt. S. G. Bastin; Sgt. J. S. Fazakerley; Sgt. W. B. Healey; Flt. Sgt. D. J. Lowe; F/O H. J. Roe; Sgt. E. Stansfield; Sgt. J. E. Stott; Sgt. J. C. Wimhurst.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. F. Barker; Sgt. G. F. Bateman; Sgt. T. Bell; Sgt. L. Black; Sgt. J. H. Bolton; P/O. A. F. Bruce; Sgt. J. S. Bucknole; Sgt. D. J. Clow; L.A/C. G. E. Cooper; Flt. Sgt. R. Critchley; Sgt. W. J. Culley; Sgt. W. B. Cundill; Sgt. P. E. H. Dangerfield; P/O. E. E. Dennis; F/O. P. G. Dexter, D.F.C.; Sgt. R. Dundas; Sgt. H. F. Eyre; Sgt. K. P. T. M. Fletcher; Wing Cdr. J. W. Gillan, D.F.C., A.F.C.; Sgt. J. W. Goddard; Sgt. S. E. Gould; Sgt. E. W. Hall; Sgt. C. Hambleton; Flt. Sgt. T. Herrington; Sgt. J. Hine; Sgt. R. C. Holyman; Flt. Sgt. R. Horsburgh; Sgt. R. E. C. Hudson; Sgt. F. Jenkins; Sgt. R. Keighley; P/O. T. D. Kerr; P/O. A. W. Lambert; Flt. Sgt. C. G. Landon; P/O. C. Landreth; Sgt. H. R. Legg; Sgt. J. R. Littlefield; Sgt. L. M. Lowry; Sgt. E. R. B. Magrath; Sgt. W. Massey; P/O. B. F. W. Mathews; Act. Flt. Lt. R. H. May; Flt. Sgt. J. I. Mell; Sgt. P. A. Milton; Sqn. Ldr. J. C. Mungo-Park, D.F.C. and Bar; Sgt. G. S. Nunn; Flt. Sgt. C. A. Parsons; P/O. J. R. Parsons; Sgt. D. E. Phare; P/O. R. J. Powell; Sgt. A. L. P. Rawlinson; Sgt. H. J. Robinson; Sgt. L. E. Scantlebury; P/O. W. J. Sears; Flt. Sgt. W. G. Sharratt; F/O. R. Shaw; Sqn. Ldr. R. H. Spencer, D.F.C.; Flt. Sgt. G. C. Starkey; P/O. M. T. K. Walkden; F/O. R. H. Wheeler; P/O. T. E Wootton; Sgt. C. F. Young.

PREVIOUSLY REPORTED PRISONER OF WAR, NOW PRESUMED KILLED IN ACTION.—Sgt. J. F. Adamson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—F/O. D. J. W. Cruickshank; Sgt. A. Dean; Flt. Lt. H. C. S. Page, D.F.C.

WOUNDED OR INJURED IN ACTION.—F/O. G. A. F. Buchanan; Sgt. D. W. Gray; Sgt. A. W. Hoyle.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. J. I. E. Davies; Sgt. E. H. Parker.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. F. Ashworth; Wing Cdr. J. W. S. Forbes; P/O. G. Wilkinson.

MISSING.—Sgt. R. D. Ash; Flt. Sgt. W. D. Biltcliffe; Sgt. P. W. Bland; Sgt. W. H. Bowers; P/O. H. C. Brown; Sgt. W. L. Cooke; A/C.1 R. N. Cornes; Sgt. P. H. Crabb; Flt. Sgt. D. Driscoll; A/C.2 J. Duff; Sgt. C. O. Forrester; P/O. C. R. Frost, D.F.M.; Sgt. S. Grunwell; Flt. Sgt. F. J. Hicks; P/O. D. R. Hockaday; Sgt. G. W. Howes; Sgt. R. A. Hudd; P/O. F. W. Jones; P/O. I. F. Livingstone; Sgt. R. J. T. Lovell; Sgt. H. D. McColl; Sgt. A. McLeod; Sgt. L. R. Meager; P/O. B. F. Mooney, D.F.M.; Act. Sqn. Ldr. J. P. V. Nicholls; Sgt. W. A. Pascoe; Sgt. D. W. Peacey; Sgt. I. J. Philip, D.F.M.; Sgt. H. R. Ray; P/O. M. G. M. Reid; W/O. S. H Stafford; Sgt. J. H. Stone; Sgt. H. P. Tew; Flt. Sgt. R. L. Willmott; Sgt. G. N. Winter; P/O. T. W. W. Woodford; Sgt. J. Woodward; Sgt. I. S. Woolf.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. N. F. T. Brown; L.A/C. E. E. C. Snell.

KILLED ON ACTIVE SERVICE.—Sgt. A. R. Alexander; P/O. L. Booth; Sqn. Ldr. G. F. Brotchie; L.A/C. L. G. Chapman; P/O. W. R. Clark; P/O. H. E. Collier; Sgt. W. Curlet; Sgt. L. S. De Lisser; A/C.2 D. A. Dickie; Sgt. H. Ellerby; Sgt. V. Fellows; Flt. Lt. H. Garnell; L.A/C. J. Gardner; Cpl. J. S. Grant; L.A/C. R. F. Greenacre; Sgt. K. N. Hebditch; A/C.2 D. A. Hill; Sgt. E. Johnson; L.A/C. J. F. Latta; L.A/C. S. Leavesley; P/O. G. E. R. Lock; L.A/C. P. A. McArdle; P/O. J. D. L. McCall; Wing Cdr. J. W. McGuire, A.F.C.; Sgt. C. McKiernan; A/C.1 H. W. Morgan; Sgt. E. Scott; Sgt. E. G. Shaw; Sgt. A. S. Simpson; Sgt. J. Town.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. D. H. Farley; Sgt. W. F. Jeffery; Sgt. L. J. Wigglesworth.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. E. W. Ashwood; Sgt. M. O. Fisher; Sgt. W. R. Meaker; Sgt. P. R. Sutton.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—Sgt. W. M. Greenbank; Sgt. M. H. J. Kilburn.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. W. Benson; Sgt. J. Heslop; Sgt. C. Hirst.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. G. White.

PREVIOUSLY REPORTED WOUNDED OR INJURED ON ACTIVE SERVICE, NOW REPORTED DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. J. P. Singleton.

DIED ON ACTIVE SERVICE.—A/C.2 C. L. Attfield; A/C.2 J. Davidson; A/C.2 W. A. Day; A/C.1 G. Foster; A/C.2 J. B. Frame; A/C.2 G. W. Henderson; Cpl. F. Hughes; L.A/C. G. M. Johnson; A/C.1 D. S. King; Act. Flt. Lt. A. Levick, O.B.E.; L.A/C. F. Manders; L.A/C. A. Matthews; A/C.2 F. Parkin; A/C.1 K. Siviter; Flt. Sgt. W. Ware; Act. Cpl. F. W. Wheatley; A/C.1 N. Wright.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. A. L. Hanes.

AMENDMENT TO CASUALTY COMMUNIQUE NO. 105.

Sgt. K. W. SQUIRRELL should have appeared under the heading "KILLED ON ACTIVE SERVICE" and not "MISSING, BELIEVED KILLED ON ACTIVE SERVICE."

AMENDMENT TO CASUALTY COMMUNIQUE No. 111.

Sgt. R. G W. Carter should have appeared under the heading "KILLED ON ACTIVE SERVICE" and not "MISSING, BELIEVED KILLED ON ACTIVE SERVICE."

AMENDMENT TO CASUALTY COMMUNIQUE No. 124.

Under the heading "MISSING," for Flt. Sgt. B. T. Dundas read Flt. Sgt. Lord B. T. Dundas.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.2 F. Tory.

DESERT COMFORT: Drivers of a repair and salvage convoy in the Western Desert stop for an evening meal.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. P. T. Elliott; Sgt. J. M. Mayall; Sgt. P. Munyard; Sgt. F. B. Reid.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. L. J. Abbott; P/O. J. F. S. Kent; Sgt. D. Macdonald.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. R. M. Ryder; P/O. J. B. Sheridan.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—P/O. K. N. Murray; Sgt. D. J. Smyth.

MISSING.—Sgt. P. C. Bucknell; Sgt. D. M. Hall; Sgt. I. E. Hart; Sgt. J. S. Turncock; Sgt. T. G. Wills.

KILLED ON ACTIVE SERVICE.—Sgt. K. A. Andrew; Sgt. H. E. Dolman; P/O. H. K. Dryden.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. J. P. W. Sellars.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. L. Kowalski.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. T. J. Arsenault; Sgt. J. F. B. Dawson; P/O. G. H. Fleming; Flt. Sgt. F. R. Humphreys; Sgt. A. B. Lesley; Sgt. J. P. Molloy; Sgt. J. B. Redden; P/O. W. E. Simpson; Sgt. G. T. Webb.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. C. J. Brakeman; Sgt. T. E. Elliott; Flt. Sgt. J. P. McKay; Sgt. G. R. Menish; Sgt. H. A. Taylor.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Flt. Sgt. R. J. Lewis.

MISSING.—P/O. D. S. Aitken; Flt. Sgt. J. A. L. Girouz; P/O. W. A. Harris.

KILLED ON ACTIVE SERVICE.—P/O. W. J. Atkinson; Sgt. W. T. Kyle; Sgt. J. F. MacPhail; Sgt. R. T. Scott.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. K. F. Druhan; Sgt. M G. Wilson.

DIED ON ACTIVE SERVICE.—A/C.1 R. J. A. G. St. Hillaire.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. R. O. Foster; Sgt. F. A. Spark; Sgt. J. S. Wilson.

MISSING.—Sgt. P. J. D. Cooney; Flt. Sgt. L. McK. Scott; P/O. O. W. Suckling.

KILLED ON ACTIVE SERVICE.—P/O. G. H Fenton; P/O. W. R. Rattray.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. A R. Tout.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. F. C. Sergeant, D.F.M.